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ENERGY EFFICIENCY/RENEWABLE ENERGY IMPACT IN THE TEXAS EMISSIONS REDUCTION PLAN (TERP)

VOLUME II—TECHNICAL REPORT

Annual Report to the
Texas Commission on Environmental Quality
January 2010-December 2010

TCEQ

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December 2011
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ENERGY SYSTEMS LABORATORY

Texas Engineering Experiment Station
The Texas A&M University System

ENERGY SYSTEMS LABORATORY
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405 Harvey Mitchell Parkway, South
College Station, Texas 77843-3581

December 22, 2011

Chairman Bryan W. Shaw
Texas Commission on Environmental Quality
P. O. Box 13087
Austin, TX 78711-3087

Dear Chairman Shaw:

The Energy Systems Laboratory (Laboratory) at the Texas Engineering Experiment Station of the Texas A&M University System is pleased to provide its ninth annual report, "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)," as required under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002 (Senate Bill 5, 77R as amended 78 R & 78S).

The Laboratory is required to annually report the energy savings from statewide adoption of the Texas Building Energy Performance Standards in Senate Bill 5 (SB 5), as amended, and the relative impact of proposed local energy code amendments in the Texas non-attainment and near-non-attainment counties as part of the Texas Emissions Reduction Plan (TERP).

Please contact me at (979) 845-1280 should you or any of the TCEQ staff have any questions concerning this report or any of the work presently being done to quantify emissions reduction from energy efficiency and renewable energy measures as a result of the TERP implementation.

Sincerely,

David E. Claridge, Ph.D., P.E.
Director

Enclosure

cc: Commissioner Carlos Rubinstein
Commissioner Buddy Garcia
Executive Director Mark R. Vickery, P.G.

Disclaimer

This report is provided by the Texas Engineering Experiment Station (TEES) as required under Section 388.003 (e) of the Texas Health and Safety Code and is distributed for purposes of public information. The information provided in this report is intended to be the best available information at the time of publication. TEES makes no claim or warranty, express or implied that the report or data herein is necessarily error-free. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement, recommendation, or favoring by the Energy Systems Laboratory or any of its employees. The views and opinions of authors expressed herein do not necessarily state or reflect those of the Texas Engineering Experiment Station or the Energy Systems Laboratory.

VOLUME II – TECHNICAL REPORT

Energy Efficiency/Renewable Energy Impact In The Texas Emissions Reduction Plan

1 Executive Summary

The Energy Systems Laboratory (Laboratory), at the Texas Engineering Experiment Station of The Texas A&M University System, in fulfillment of its responsibilities under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002, submits its ninth annual report, Energy Efficiency/Renewable Energy (EE/RE) Impact in the Texas Emissions Reduction Plan (TERP) to the Texas Commission on Environmental Quality.

The report is organized in three volumes.

- Volume I – Summary Report – provides an executive summary and overview;
- Volume II – Technical Report – provides a detailed report of activities, methodologies and findings;
- Volume III – Technical Appendix – contains detailed data from simulations for each of the counties included in the analysis.

Accomplishments:

1. Energy Code Amendments

The Laboratory was requested by several Councils of Governments (COGs) and municipalities to analyze the stringency of several proposed residential and commercial energy code amendments, including: the 2003 and 2006 IECC and the ASHRAE Standards 90.1-2001 and 90.1-2004. Results of the analysis are included in this Volume II-Technical Report.

2. Technical Assistance

The Laboratory provided technical assistance to the TCEQ, PUCT, SECO, ERCOT, and several political subdivisions, as well as stakeholders participating in improving the compliance of the Texas Building Energy Performance Standards (TBEPS). The Laboratory also worked closely with the TCEQ to refine the integrated NOx emissions reduction calculation procedures that provide the TCEQ with a standardized, creditable NOx emissions reduction from energy efficiency and renewable energy (EE/RE) programs, which are acceptable to the US EPA. These activities have improved the accuracy of the creditable NOx emissions reduction from EE/RE initiatives contained in the TERP and have assisted the TCEQ, local governments, and the building industry with effective, standardized implementation and reporting.

3. NOx Emissions Reduction

Under the TERP legislation, the Laboratory must determine the energy savings from energy code adoption and, when applicable, from more stringent local codes or above-code performance ratings, and must report these reductions annually to the TCEQ.

Figure 1 shows the cumulative NOx emissions reduction through 2020 for the electricity and natural gas savings from the various EE/RE programs.

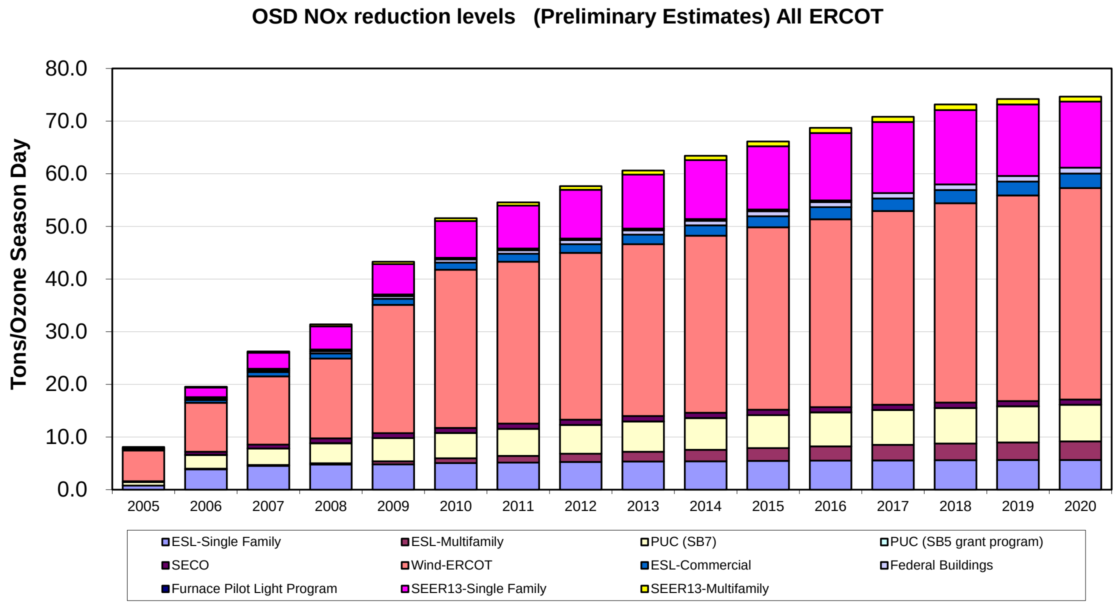

Figure 1: OSD NOx Emissions Reduction Projections through 2020

In 2010, the total NOx emissions reduction from all programs is 15,327 tons-NOx/year which is broken down by the following:

- The cumulative annual NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 1,189 tons-NOx/year (7.8% of the total NOx savings);
- Savings from retrofits to Federal buildings is 193 tons-NOx/year (1.3%);
- Savings from furnace pilot light retrofits is 117 tons-NOx/year (0.8%);
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 1,637 tons-NOx/year (10.7%);
- Savings from SECO's Senate Bill 5 program is 349 tons-NOx/year (2.3%);
- Electricity savings from green power purchases (wind) is 10,957 tons-NOx/year (71.5%); and
- Savings from residential air conditioner retrofits is 884 tons-NOx/year (5.8%).

In addition, the following OSD NOx reductions are expected for 2010:

- The OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 6.56 tons-NOx/day (16.1%);
- Savings from retrofits to Federal buildings is 0.51 tons-NOx/day (1.3%);
- Savings from furnace pilot light retrofits is 0.32 tons-NOx/day (0.8%);
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 4.39 tons-NOx/day (10.8%);
- Savings from SECO's Senate Bill 5 program is 0.95 tons-NOx/day (2.3%);
- Electricity savings from green power purchases (wind) are 21.79 tons-NOx/day (53.5%); and
- Savings from residential air conditioner retrofits are 6.19 tons-NOx/day (15.2%).

The total NOx emissions reduction from all programs is 40.71 tons-NOx/day.

Looking into the future, the 2013 cumulative NOx emissions reduction is projected to be:

- Code-compliant residential and commercial construction is calculated to be 1,540 tons-NOx/year (8.0% of the total NOx savings);
- Savings from retrofits to Federal buildings will be 308 tons-NOx/year (1.6%);
- Savings from furnace pilot light retrofits will be 117 tons-NOx/year (0.6%);

- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 2,336 tons-NOx/year (12.1%);
- Savings from SECO's Senate Bill 5 program will be 373 tons-NOx/year (1.9%);
- Electricity savings from green power purchases (wind) will be 13,065 tons-NOx/year (67.6%); and
- Savings from residential air conditioner retrofits will be 1,575 tons-NOx/year (8.2%).

The total NOx emissions reduction from all programs will be 19,314 tons-NOx/year.

Similarly, the projected 2013 OSD NOx emissions reduction is:

- Code-compliant residential and commercial construction is calculated to be 8.72 tons-NOx/day (16.1%);
- Savings from retrofits to Federal buildings will be 0.81 tons-NOx/day (1.5%);
- Savings from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.6%);
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 6.28 tons-NOx/day (11.6%);
- Savings from SECO's Senate Bill 5 program will be 1.01 tons-NOx/day (1.9%);
- Electricity savings from green power purchases (wind) will be 25.99 tons-NOx/day (48.0%); and
- Savings from residential air conditioner retrofits will be 11.03 tons-NOx/day (20.4%).

The total NOx emissions reduction from all programs will be 54.16 tons-NOx/day.

4. Technology Transfer

The Laboratory, along with the TCEQ, hosts the annual Clean Air Through Energy Efficiency (CATEE) conference, which is attended by top experts and policy makers in Texas and from around the country. At the conference, the latest educational programs and technology is presented and discussed, including efforts by the Laboratory, and others, to reduce air pollution in Texas through energy efficiency and renewable energy. These efforts have produced significant success in bringing EE/RE closer to US EPA acceptance in the Texas SIP. The Laboratory will continue to provide superior technology to the State of Texas through such efforts with the TCEQ and the US EPA.

To accelerate the transfer of technology developed as part of the TERP, the Laboratory has also made presentations at national, state and local meetings and conferences, which includes the publication of peer-reviewed papers. The Laboratory will continue to provide technical assistance to the TCEQ, counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering emissions and improving the air quality for all Texans.

These efforts have been recognized nationally by the US EPA. In 2007, the Laboratory was awarded a National Center of Excellence on Displaced Emissions Reduction (CEDER) by the US EPA so that these accomplishments could be rapidly disseminated to other states for their use. The benefits of CEDER include:

- Reducing the financial, technical, and administrative costs of determining the emissions reduction from EE/RE measures;
- Continuing to accelerate implementation of EE/RE strategies as a viable clean air effort in Texas and other states;
- Helping other states better identify and prioritize cost-effective clean air strategies from EE/RE; and
- Communicating the results of quantification efforts through case-studies and a clearinghouse of information.

The Energy Systems Laboratory provides the ninth annual report, Energy Efficiency/Renewable Energy (EE/RE) Impact in the Texas Emissions Reduction Plan (TERP), to the Texas Commission on Environmental Quality (TCEQ) in fulfillment of its responsibilities under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002. If any questions arise, please contact us by phone at 979-862-2804, or by email at terpinfo@tees.tamus.edu.

2 Acknowledgements

This work has been completed as a fulfillment of the requirements in Texas Health Code, Senate Bill 5, Section 388.003, and through Senate Bill 20, House Bill 2481 and House Bill 2129, which requires the Laboratory to assist TCEQ in quantifying emissions reductions credits from energy efficiency and renewable energy programs, through a contract with the Texas Environmental Research Consortium (TERC). Similarly, selected Code training workshops were funded by the US DOE through the Texas State Energy Conservation Office (SECO). Partial funding on the Texas Climate Vision project, a joint project with the City of Austin was also provided by the US DOE through SECO.

The authors are also grateful for the timely input provided by the following individuals, and agencies: Mr. Art Diem, US EPA, for providing the eGRID database and Vincent Meiller and Robert Gifford, TCEQ.

Numerous additional individuals at the Laboratory contributed significantly to this report, including: Juan-Carlos Baltazar, Jaya Mukhopadhyay, Hyojin Kim, Robert Stackhouse, Kyle Marshall, Stephen O'Neal, and Rose Sauser

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3 Overview

The Energy Systems Laboratory (Laboratory), at the Texas Engineering Experiment Station of the Texas A&M University System, is pleased to provide our ninth annual report, Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP), to the Texas Commission on Environmental Quality (TCEQ) in fulfillment of its responsibilities under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002. This annual report:

- Provides an estimate of the energy savings and NOx reductions from energy code compliance in new residential construction in all ERCOT counties;
- Provides an estimate of the standardized, cumulative, integrated energy savings and NOx reductions from the TERP programs implemented by the Laboratory, SECO, the PUC and ERCOT in all ERCOT Texas;
- Describes the technology developed to enable the TCEQ to substantiate energy and emissions reduction credits from energy efficiency and renewable energy initiatives (EE/RE) to the U.S. Environmental Protection Agency (US EPA), including the development of a web-based emissions reduction calculator; and
- Outlines progress in advancing EE/RE strategies for credit in the Texas State Implementation Plan (SIP).

The report is organized in three volumes.

Volume I – Summary Report – provides an executive summary and overview;
Volume II – Technical Report – provides a detailed report of activities, methodologies and findings; and
Volume III – Technical Appendix – contains detailed data from code-compliant energy simulations for all ERCOT counties in Texas included in the analysis.

3.1 Legislative Background

The TERP was established in 2001 by the 77th Legislature through the enactment of Senate Bill 5 to:

- Ensure that Texas air meets the Federal Clean Air Act requirements (Section 707, Title 42, United States Code); and
- Reduce NOx emissions in non-attainment and near-non-attainment counties through mandatory and voluntary programs, including the implementation of energy efficiency and renewable energy programs (EE/RE).

To achieve the clean air and emissions reduction goals of the TERP, Senate Bill 5 created a number of EE/RE programs for credit in the SIP:

- Adopts statewide Texas Building Energy Performance Standards (TBEPS) as the building energy code for all residential and commercial buildings;
- Provides that a municipality or county may request the Laboratory to determine the energy impact of proposed energy code changes;
- Provides for an annual evaluation by the Public Utility Commission of Texas (PUCT), in cooperation with the Laboratory, of the emissions reduction of energy demand, peak electric loads and the associated air contaminant reductions from utility-sponsored programs established under Senate Bill 5 and utility-sponsored programs established under the electric utility restructuring act (Section 39.905 Utilities Code);
- Establishes a 5% per year electricity reduction goal each year for facilities of political subdivisions in non-attainment and near-non-attainment counties from 2002 through 2009; and
- Requires the Laboratory to report annually to the TCEQ the energy savings (and resultant emissions reduction) from implementation of building energy codes and to identify the municipalities and counties whose codes are more or less stringent than the un-amended code.

Passed during the 78th Legislature (2003), HB 1365 and HB 3235 amended TERP to enhance its effectiveness with these additional energy efficiency initiatives:

- Requires the TCEQ to conduct outreach to non-attainment and near-non-attainment counties on the benefits of implementing energy efficiency measures as a way to meet the air quality goals under the federal Clean Air Act;
- Requires the TCEQ develop a methodology for computing emissions reduction from energy efficiency initiatives;
- Authorized a voluntary Energy-Efficient Building Program at the General Land Office (GLO), in consultation with the Laboratory, for the accreditation of buildings that exceed the state energy code requirements by 15% or more;

- Authorizes municipalities to adopt an optional, alternate energy code compliance mechanism through the use of accredited energy efficiency programs determined to be code-compliant by the Laboratory, as well as the US EPA's Energy Star New Homes program; and
- Requires the Laboratory to develop and administer a statewide training program for municipal building inspectors seeking to become code-certified inspectors for enforcement of energy codes.

Senate Bill 5 was again amended during the 79th Legislature (2005) through SB 20, HB 2481 and HB 2129. These enhanced the effectiveness of Senate Bill 5 by adding the following additional energy efficiency initiatives:

- Requires 5,880 MW of generating capacity from renewable energy technologies by 2015;
- Includes 500 MW from non-wind renewables;
- Requires the PUCT to establish a target of 10,000 megawatts of installed renewable capacity by 2025;
- Requires the TCEQ to develop methodology for computing emissions reduction from renewable energy initiatives and the associated credits;
- Requires the Laboratory to assist the TCEQ in quantifying emissions reduction credits from energy efficiency and renewable energy programs;
- Requires the Texas Environmental Research Consortium (TERC) to contract with the Laboratory to develop and annually calculate creditable emissions reduction from wind and other renewable energy resources for the state's SIP; and
- Requires the Laboratory to develop at least three alternative methods for achieving a 15 % greater potential energy savings in residential, commercial and industrial construction.

The 80th Legislature (2007), through SB 12, and HB 3693 further amended Senate Bill 5 to enhance its effectiveness by adding the following additional energy efficiency initiatives:

- Requires the Laboratory to provide written recommendations to the State Energy Conservation Office (SECO) about whether or not the energy efficiency provisions of latest published edition of the International Residential Code (IRC) or the International Energy Conservation Code (IECC) are equivalent to or better than the energy efficiency and air quality achievable under the editions adopted under the 2001 IRC/IECC. The Laboratory shall make its recommendations no later than six months after publication of new editions at the end of each three-year code development cycle of the International Residential Code and the International Energy Conservation Code.
- Requires the Laboratory to consider comments made by persons who have an interest in the adoption of the energy codes in the recommendations made to SECO.
- Requires the Laboratory to develop a standardized report format to be used by providers of home energy ratings, including different report formats for rating newly constructed residences from those for existing residences. The form must be designed to give potential buyers information on a structure's energy performance, including: insulation; types of windows; heating and cooling equipment; water heating equipment; additional energy conserving features, if any; results of performance measurements of building tightness and forced air distribution; and an overall rating of probable energy efficiency relative to the minimum requirements of the International Energy Conservation Code or the energy efficiency chapter of the International Residential Code, as appropriate.
- Encourages the Laboratory to cooperate with an industry organization or trade association to: develop guidelines for home energy ratings; provide training for individuals performing home energy ratings and providers of home energy ratings; and provide a registry of completed ratings for newly constructed residences and residential improvement projects for the purpose of computing the energy savings and emissions reduction benefits of the home energy ratings program.
- Requires the Laboratory to include information on the benefits attained from this program in an annual report to the commission.

The 81st Legislature, 2009, extended the date of the TERP to 2019 and required the TCEQ to contract with Laboratory to compute emissions reduction from wind and other renewable energy resources for the SIP.

3.2 Laboratory Funding for the TERP

The Laboratory received $182,000 in FY 2002; $285,000 in FY 2003; $950,421 in FY 2004; $952,019 each year for FY 2005 through FY2008. In FY 2009 the Lab received $908,040 and $870,568 in FY 2010. The Laboratory has also supplemented these funds with competitively awarded Federal and State grants to provide the needed statewide training for the new mandatory energy codes and to provide technical assistance to cities and counties in helping them implement adoption of the legislated energy efficiency codes. In addition, the ESL received an award from the US EPA in the spring of 2007 to establish a Center of Excellence for the Determination of Emissions Reduction (CEDER) which has helped to enhance the EE/RE emissions calculations.

3.3 Accomplishments since January 2010

Since January 2010, the Laboratory has accomplished the following:

- Calculated energy and resultant NOx reductions from implementation of the Texas Building Energy Performance Standards (IECC/IRC codes) to new residential and commercial construction for all non-attainment and near-non-attainment counties;
- Enhanced the Laboratory's IECC/IRC Code-Traceable Test Suite for determining emissions reduction due to code and above-code programs;
- Enhanced the IC3 calculator, which is energy code compliance software based on the Texas Building Energy Performance Standards by adding 3-story, multi-family model in the calculator and extending the code to include Houston Amendments and 2009 IECC;
- Continued development and testing of key procedures for validating simulations of building energy performance;
- Provided energy code training workshops, including: residential, commercial IECC/IRC energy code training sessions, code-compliant software sessions throughout the State of Texas;
- Maintained and updated the Laboratory's Texas Emissions Reduction Plan (TERP) website;
- Maintained a builder's residential energy code Self-Certification Form (Ver.1.3) for use by builders outside municipalities;
- Analyzed the stringency of several residential and commercial energy codes, including the 2009 IECC, 2009 IRC and ASHRAE Standard 90.1 2007;
- Hosted the Clean Air Through Energy Efficiency (CATEE) Conference in August 2010, in Austin, Texas. Conference sessions included key talks by the TCEQ, EPA, DOE and the Laboratory about quantifying emissions reduction from EE/RE opportunities and guidance on key energy efficiency and renewable energy topics;
- Provided technical assistance to the TCEQ regarding specific issues, including:
    - Enhancement of the standardized, integrated NOx emissions reduction reporting procedures to the TCEQ for EE/RE projects;
    - Enhancement of the procedures for weather normalizing NOx emissions reduction from renewable projects;
- Enhanced the web-based emissions reduction calculator, including:
    - Continued the enhancement of the new computer architecture to allow for synchronous calculations, user accounts, and code-compliance;
- Developed 15% above code recommendations for residential buildings;
- Continued the development of verification procedures, including:
    - Worked toward the code compliance tools for commercial buildings, retail and school buildings.

3.4 Technology Transfer

To accelerate the transfer of technology developed as part of the TERP program, the Laboratory:

- Delivered "Statewide Air Emissions Calculations from Wind and Other Renewables," to the Texas Commission on Environmental Quality in August 2009.
- Updated previously developed degradation analysis to determine if degradation could be observed in the measured power from Texas wind farms.
- Updated previously developed database of other renewable projects in Texas, including: solar photovoltaic, geothermal, hydroelectric, and Landfill Gas-fired Power Plants.
- Applied previously developed estimation techniques for hourly solar radiation from limited data sets.
- Worked with the EPA and TCEQ and developed a new version of eGRID for all ERCOT counties in Texas.

- Along with the TCEQ and the US EPA, is host to the annual Clean Air Through Energy Efficiency (CATEE) Conference attended by top Texas experts and policy makers and national experts.
- Continued the National Center of Excellence on Displaced Emissions Reduction (CEDER) by the US EPA. The benefits of CEDER include:
  - Reducing the financial, technical, and administrative costs of determining the emissions reduction from EE/RE measures;
  - Continuing to accelerate implementation of EE/RE strategies as a viable clean air effort in Texas and other states;
  - Helping other states identify and prioritize cost-effective clean air strategies from EE/RE, and;
  - Communicating the results of quantification efforts through case-studies and a clearinghouse of information.

In addition to the tasks listed above, the Laboratory delivered presentations regarding the TERP related work, including:

- Presentation to the Clean Air Through Energy Efficiency Conference, Austin, Texas, August 2010
- Presentation to the Symposium on Improving Building Systems in Hot & Humid Climates, Austin, Texas, August 2010
- Presentation to SIMBuild, New York, New York, August 2010
- Presentation to International Conference for Enhanced Building Operations, Safat Kuwait, October 2010

Presentation of the following seven papers at the Symposium on Improving Building Systems in Hot & Humid Climates, Austin, Texas, August 2010:

- Kim, K.; Haberl, J. 2010. “Development of a Calibration Methodology for Code-compliant Simulation of a Case Study House in a Hot and Humid Climate,” *Proceedings of the 17th Symposium on Improving Building Systems in Hot and Humid Climates*, Austin, Texas
- Ji, J.; Baltazar, J.C.; Claridge, D. 2010. “Development of the Potential Energy Savings Estimation (PESE) Toolkit,” *Proceedings of the 17th Symposium on Improving Building Systems in Hot and Humid Climates*, Austin, Texas
- Do, S.; Haberl, J. 2010. “A Review of Ground Coupled Heat Pump Models Used in Whole-Building Computer Simulation Programs,” *Proceedings of the 17th Symposium on Improving Building Systems in Hot and Humid Climates*, Austin, Texas
- Gilman, D.; Haberl, J.; Kayati, M.; O’Neal, S. 2010. “Development of a Texas Building Registry,” *Proceedings of the 17th Symposium on Improving Building Systems in Hot and Humid Climates*, Austin, Texas
- Mukhopadhyay, J.; Baltazar, J.C.; Liu, Z.; Haberl, J.; Culp, C.; Yazdani, B. 2010. “A Comparative Analysis of Residential Energy Use for 2009 IECC Code Compliance and 2001 IECC Compliance with 2006 NACA Appliance Standards for Selected Climate Zones in Texas,” *Proceedings of the 17th Symposium on Improving Building Systems in Hot and Humid Climates*, Austin, Texas
- Kim, H.; Liu, Z.; Baltazar, J.C.; Mukhopadhyay, J.; Haberl, J., Do, S.; Culp, C.; Yazdani, B. 2010. “Energy Efficiency/Renewable Energy (RE/EE) Projects in Texas Public Schools,” *Proceedings of the 17th Symposium on Improving Building Systems in Hot and Humid Climates*, Austin, Texas
- Alcocer, J.L.B.; Haberl, J. 2010 “Low Impact, Affordable, Low Income Houses for Mexico,” *Proceedings of the 17th Symposium on Improving Building Systems in Hot and Humid Climates*, Austin, Texas

Presentation of six papers to the 2010 SimBuild Conference held in New York City, August 2010.

- Marshall, K.; Moss, M.; Malhotra, M.; Liu, Z.; Culp, C.; Haberl, J.; Herbert, C. 2010 “AIM: Web-Based, Residential Energy Calculator for Homeowners,” *SimBuild 2010*, New York City, New York
- Andulson, S.; Culp, C.; Haberl, J. 2010 “EnergyPlus vs DOE-2: The Effects of Ground Coupling on Heating and Cooling Energy Consumption of a Slab-on-grad Code House in a Cold Climate,” *SimBuild 2010*, New York City, New York
- Cho, S.; Haberl, J. 2010 “Integrating Solar Thermal and Photovoltaic Systems in Whole Building Energy Simulation,” *SimBuild 2010*, New York City, New York

- Im, P.; Haberl, J. 2010 "Analysis of the Energy Savings Potential in K-5 Schools in Hot and Humid Climates: Application of High Performance Measures and Renewable Energy Systems," *SimBuild 2010*, New York City, New York
- Liu, Z.; Kim, H.; Malholtra, M.; Mukhopadhyay, J.; Baltazar, J-C.; Haberl, J.; Culp, C.; Yazdani, B.; Montgomery, C. 2010 "Going Beyond RESNET Certification for Code-Compliance Simulations: A Comparison of Detailed Results of Three RESNET-Certified, Code-Compliant Residential Simulation Programs," *SimBuild 2010*, New York City, New York
- Malhotra, M., Haberl, J. 2010 "Simulated Building Energy Performance of Single-Family Detached Residences Designed for Off-Grid, Off-Pipe," *SimBuild 2010*, New York City, New York

Presentation of four papers at the 10th International Conference for Enhanced Building Operations, held in Safat, Kuwait, October 2010.

- Liu, J.; Baltazar, J.C.; Claridge, D. 2010 "Analysis of the Potential Savings for 14 Office Buildings with VAV Systems," *Proceedings of the 10th International Conference for Enhanced Building Operations*, Safat, Kuwait
- Baltazar, J.C.; Liu, Z.; Mukhopadhyay, J.; Marshall, K.; Gilman, D.; Lewis, C.; McKelvey, K.; Reid, V.; Haberl, J.; Culp, C.; Yazdani, B. 2010 "A Methodology for Calculating Integrated NOx Emissions Reductions from Energy Efficient and Renewable Energy (EE/RE) Programs across State Agencies in Texas," *Proceedings of the 10th International Conference for Enhanced Building Operations*, Safat, Kuwait
- Kim, S.; Haberl, J. 2010 "Application of an ASHRAE 152-2004 Duct Model for Simulating Code-Compliant 2000/2001 IECC Residences," *Proceedings of the 10th International Conference for Enhanced Building Operations*, Safat, Kuwait
- Liu, Z.; Kim, H.; Mukhopadhyay, J.; Montgomery, C.; Baltazar, J.C.; Haberl, J.; Culp, C.; Yazdani, B. 2010 "Going Beyond a Resnet Certification for Code-Compliant Simulations: A Sensitivity Analysis of Detailed Results of Three Resnet-Certified, Code-Compliant Residential Simulation Programs," *Proceedings of the 10th International Conference for Enhanced Building Operations*, Safat, Kuwait

The Laboratory has and will continue to provide leading-edge technical assistance to the TCEQ, counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering emissions and improving the air quality for all Texans. The Laboratory will continue to provide superior technology to the State of Texas through efforts with the TCEQ and US EPA. The efforts taken by the Laboratory have produced significant success in bringing EE/RE closer to US EPA acceptance in the SIP. These activities were designed to more accurately calculate the creditable NOx emissions reduction from EE/RE initiatives contained in the TERP and to assist the TCEQ, local governments, and the building industry with standardized, effective implementation and reporting.

3.5 Energy and NOx Reductions from New Residential and Commercial Construction, Including Furnace Pilot Light Savings and Residential Air Conditioner Retrofits

State adoption of the energy efficiency provisions of the International Residential Code (IRC) and International Energy Conservation Code (IECC) became effective September 1, 2001. The Laboratory has developed and delivered training to assist municipal inspectors to become certified energy inspectors. The Laboratory also supported code officials with guidance on interpretations as needed. This effort, based on a requirement of HB 3235, 78th Texas Legislature, supports a more uniform interpretation and application of energy codes throughout the state. In general, the State is experiencing a true market transformation from low energy efficiency products to high energy efficiency products. These include: low solar heat gain windows, higher efficiency appliances, high efficiency air conditioners and heat pumps, increased insulation, lower thermal loss ducts and in-builder participation in "above-code" code programs such as Energy Star New Homes, which previously had no state baseline and almost no participation.

In 2010 the following savings were calculated:

- In 2010, the annual electricity savings[1] from code-compliant residential and commercial construction is calculated to be 1,688,687 MWh/year (6.6% of the total electricity savings);
- Savings from furnace pilot light retrofits is 2,548,904 MBtu/year; and
- Savings from residential air conditioner retrofits[2] is 1,283,931 MWh/year (5.0%).

- In 2010, the OSD electricity savings from code-compliant residential and commercial construction is calculated to be 9,510 MWh/day (14.3%),
- Savings from furnace pilot light retrofits is 6,983 MBtu/day, and
- Savings from residential air conditioner retrofits are 9,106 MWh/day (13.7%).

- By 2013, the annual electricity savings from code-compliant residential and commercial construction is calculated to be 2,176,034 MWh/year (6.8% of the total electricity savings);
- Savings from furnace pilot light retrofits will remain at 2,548,904 MBtu/year; and
- Savings from residential air conditioner retrofits[3] will be 2,286,233 MWh/year (7.1%).

- By 2013, the OSD electricity savings from code-compliant residential and commercial construction is calculated to be 12,566 MWh/day (14.4%);
- Savings from furnace pilot light retrofits will remain at 6,983 MBtu/day; and
- Savings from residential air conditioner retrofits will be 16,216 MWh/day (18.6%).

- In 2010, the annual NOx emissions reduction[4] from code-compliant residential and commercial construction is calculated to be 1,090 tons-NOx/year (7.8% of the total NOx savings);
- Savings from furnace pilot light retrofits is 117 tons-NOx/year (0.8%); and
- Savings from residential air conditioner retrofits is 884 tons-NOx/year (5.8%).

- In 2010, the OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 6.56 tons-NOx/day (16.1%);
- Savings from furnace pilot light retrofits is 0.32 tons-NOx/day (0.8%); and
- Savings from residential air conditioner retrofits are 6.19 tons-NOx/day (15.2%).

- By 2013, the NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 1,541 tons-NOx/year (8.0% of the total NOx savings);
- Savings from furnace pilot light retrofits will be 117 tons-NOx/year (0.6%); and
- Savings from residential air conditioner retrofits will be 1,574 tons-NOx/year (8.1%).

[1] This includes the savings from 2001 through 2010.
[2] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.
[3] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.
[4] These NOx emissions reductions were calculated with the US EPA's 2007 eGRID for annual (25% capacity factor) and Ozone Season Day OSD.

- By 2013, the OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 8.72 tons-NOx/day (16.1%);
- Savings from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.6 %); and
- Savings from residential air conditioner retrofits will be 11.03 tons-NOx/day (20.4%).

3.6 Integrated NOx Emissions Reductions Reporting Across State Agencies

In 2005, the Laboratory began to work with the TCEQ to develop a standardized, integrated NOx emissions reduction across state agencies implementing EE/RE programs so that the results can be evaluated consistently. As required by the legislation, the TCEQ receives the following reports:

- From the Laboratory – savings from code compliance and renewables;
- From the Laboratory, in cooperation with the Electric Reliability Council of Texas (ERCOT), the savings from electricity generated from wind power;
- From the Public Utilities Commission of Texas (PUCT) on the impacts of the utility-administered programs designed to meet the mandated energy efficiency goals of SB7 and SB5; and
- From the State Energy Conservation Office (SECO) on the impacts of energy conservation in state agencies and political subdivisions.

The total annual and OSD electricity savings for all the different programs in the integrated format was calculated using the adjustment factors for 2001 through 2020. NOx emissions reduction from the electricity and natural gas savings for the annual and OSD for all the programs in the integrated format were calculated.

In 2010 the cumulative annual electricity savings[5] is calculated as follows:

- Savings from code-compliant residential and commercial construction is 1,854,699 MWh/year (5.8% of the total electricity savings),
- Savings from retrofits to Federal buildings is 293,659 MWh/year (0.9%),
- Savings from furnace pilot light retrofits is 2,548,904 MMBtu/year (2.4%), which is equivalent to 746,822 MWh/year,
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 2,595,953 MWh/year (8.2%),
- Savings from SECO's Senate Bill 5 program is 468,611 MWh/year (1.5%),
- Electricity savings from green power purchases (wind) is 24,210,883 MWh/year (76.3%), and
- Savings from residential air conditioner retrofits is 1,560,875 MWh/year (4.9%).

The total savings from all programs is 31,731,502 MWh/year.

In 2010 the cumulative OSD electricity savings is calculated as follows:

- Savings from code-compliant residential and commercial construction is 10,641 MWh/day (12.6%),
- Savings from retrofits to Federal buildings is 805 MWh/day (1.0%),
- Savings from furnace pilot light retrofits is 6,983 MMBtu/day (2.4%), which is equivalent to 2,046 MWh/day,
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 7,113 MWh/day (8.5%),
- Savings from SECO's Senate Bill 5 program is 1,284 MWh/day (1.5%),
- Electricity savings from green power purchases (wind) are 51,190 MWh/day (60.8%), and
- Savings from residential air conditioner retrofits are 11,071 MWh/day (13.2%).

The total savings from all programs in 2010 is 84,150 MWh/day (82,104 MWh/day and 6,983 MMBtu/day), which would be a 3,506 MW average hourly load reduction during the OSD period.

By 2013, the projected cumulative annual electricity savings from all the different programs is:

- Savings from code-compliant residential and commercial construction will be 2,311,539 MWh/year (6.5% of the total electricity savings),

[5] This includes the savings from 2001 through 2010.

- Savings from retrofits to Federal buildings will be 402,732 MWh/year (1.1%),
- Savings from furnace pilot light retrofits will remain at 2,548,904 MMBtu/year (2.1%), which is equivalent to 746,822 MWh/year,
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 3,224,560 MWh/year (9.0%),
- Savings from SECO's Senate Bill 5 program will be 489,440 MWh/year (1.4%),
- Electricity savings from green power purchases (wind) will be 26,296,721 MWh/year (73.5%), and
- Savings from residential air conditioner retrofits[6] will be 2,286,233 MWh/year (6.4%).

The total cumulative annual savings from all programs will be 35,758,047 MWh/year (35,011,225 MWh/year and 2,548,904 MMBtu/year).

By 2013, the projected cumulative OSD electricity savings will be:

- Savings from code-compliant residential and commercial construction will be 13,157 MWh/day (13.4%),
- Savings from retrofits to Federal buildings will be 1,103 MWh/day (1.1%),
- Savings from furnace pilot light retrofits will remain at 6,983 MMBtu/day (2.1%), which is equivalent to 2,046 MWh/day,
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 8,835 MWh/day (9.0%),
- Savings from SECO's Senate Bill 5 program will be 1,341 MWh/day (1.4%),
- Electricity savings from green power purchases (wind) will be 55,600 MWh/day (56.6%), and
- Savings from residential air conditioner retrofits will be 16,216 MWh/day (16.5%).

The total cumulative OSD savings from all programs will be 98,298 MWh/day (96,252 MWh/day and 6,983 MMBtu/day), which would be a 4,096 MW average hourly load reduction during the OSD period.

In 2010 the cumulative annual NOx emissions reduction[7] from all the different programs is:

- Reduction from code-compliant residential and commercial construction is 1,303 tons-NOx/year (6.9% of the total NOx savings),
- Reduction from retrofits to Federal buildings is 225 tons-NOx/year (1.2%),
- Reduction from furnace pilot light retrofits is 117 tons-NOx/year (0.6%),
- Reduction from the PUC's Senate Bill 5 and Senate Bill 7 programs is 1,783 tons-NOx/year (9.4%),
- Reduction from SECO's Senate Bill 5 program is 357 tons-NOx/year (1.9%),
- Reduction from green power purchases (wind) is 14,047 tons-NOx/year (74.3%), and
- Reduction from residential air conditioner retrofits is 1,075 tons-NOx/year (5.7%).

The total cumulative annual NOx emissions reduction from all programs is 18,907 tons-NOx/year.

In 2010, the cumulative OSD NOx emissions reduction from all the different programs is:

- Reduction from code-compliant residential and commercial construction is 7.34 tons-NOx/day (14.2%),
- Reduction from retrofits to Federal buildings is 0.59 tons-NOx/day (1.1%),
- Reduction from furnace pilot light retrofits is 0.32 tons-NOx/day (0.6%),
- Reduction from the PUC's Senate Bill 5 and Senate Bill 7 programs is 4.79 tons-NOx/day (9.3%),
- Reduction from SECO's Senate Bill 5 program is 0.97 tons-NOx/day (1.9%),
- Reduction from green power purchases (wind) are 30.04 tons-NOx/day (58.2%), and
- Reductions from residential air conditioner retrofits are 7.53 tons-NOx/day (14.6%).

The total cumulative OSD NOx emissions reduction from all programs is 51.58 tons-NOx/day.

By 2013, the projected cumulative annual NOx emissions reduction from all the different programs will be:

- Reduction from code-compliant residential and commercial construction will be 1,620 tons-NOx/year (7.6% of the total NOx savings),
- Reduction from retrofits to Federal buildings will be 308 tons-NOx/year (1.4%),
- Reduction from furnace pilot light retrofits will be 117 tons-NOx/year (0.5%),
- Reduction from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 2,147 tons-NOx/year (10.0%),
- Reduction from SECO's Senate Bill 5 program will be 373 tons-NOx/year (1.7%),

[6] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.

[7] These NOx emissions reductions were calculated with the US EPA's 2007 eGRID for annual (25% capacity factor) and Ozone Season Day OSD.

- Reduction from green power purchases (wind) will be 15,257 tons-NOx/year (71.3%), and
- Reduction from residential air conditioner retrofits will be 1,574 tons-NOx/year (7.4%).

The total cumulative annual NOx emissions reduction from all programs will be 21,396 tons-NOx/year.

By 2013, the projected cumulative OSD NOx emissions reduction from all the different programs will be:

- Reduction from code-compliant residential and commercial construction will be 9.03 tons-NOx/day (14.9%),
- Reduction from retrofits to Federal buildings will be 0.81 tons-NOx/day (1.3%),
- Reduction from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.5%),
- Reduction from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 5.78 tons-NOx/day (9.5%),
- Reduction from SECO's Senate Bill 5 program will be 1.01 tons-NOx/day (1.7%),
- Reduction from green power purchases (wind) will be 32.63 tons-NOx/day (53.8%), and
- Reduction from residential air conditioner retrofits will be 11.03 tons-NOx/day (18.2%).

The total cumulative OSD NOx emissions reduction from all programs is projected to be 60.61 tons-NOx/day.

Figure 2 shows the NOx emissions reduction through 2020 for the electricity and natural gas savings from all TERP programs reporting to the TCEQ. Table 1 provides the details regarding the annual degradation, transmission and distribution losses, discount factors and growth factors that were used in the analysis[8]. Additional details of the analysis are reported in Volume III of this report.

Table 1: Adjustment Factors used for the Calculation of the Annual and OSD NOx Savings for the Different Programs

	ESL-Single Family[16]	ESL-Multifamily[16]	ESL-Commercial[16]	Federal Buildings[15]	Furnace Pilot Light Program[15]	PUC (SB7)[15]	PUC (SB5 Grant Program)[15]	SECO[15]	Wind-ERCOT[8]	SEER13 Single Family	SEER13 Multifamily
Annual Degradation Factor [11]	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	0.00%	5.00%	5.00%
T&D Loss [9]	7.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%
Initial Discount Factor [12]	20.00%	20.00%	20.00%	20.00%	20.00%	25.00%	25.00%	60.00%	25.00%	20.00%	20.00%
Growth Factor	3.25%	1.54%	3.25%	0.00%	0.00%	0.00%	0.00%	0.00%	Actual Rates	N.A.	N.A.
Weather Normalized	Yes	Yes	Yes	No	No	No	No	No	See note 7	Yes	Yes

[8] These factors were determined by TCEQ.

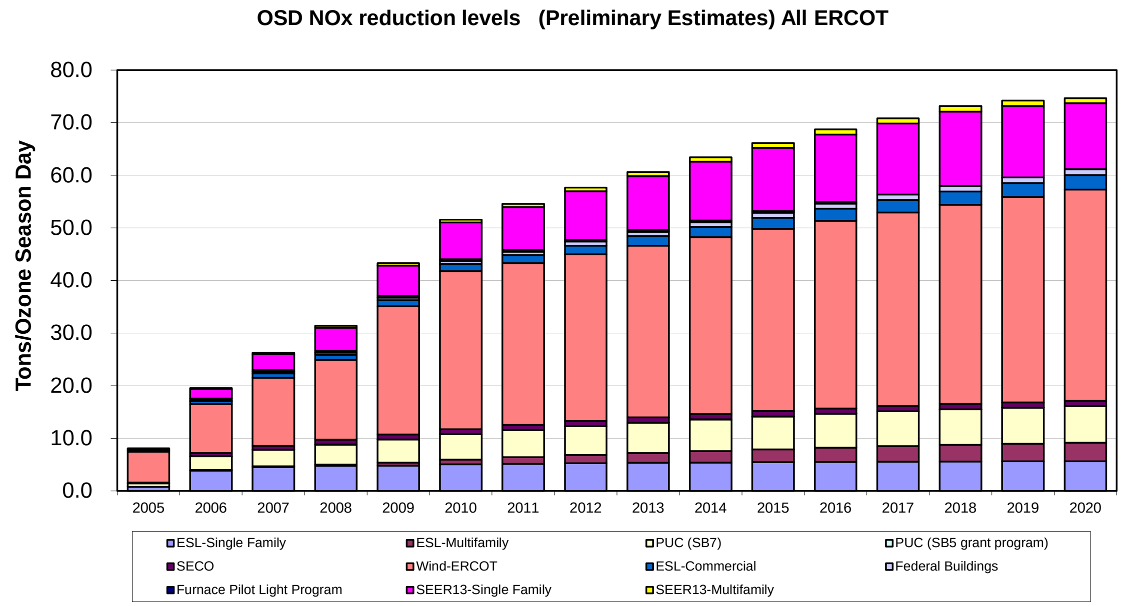


Figure 2: Cumulative OSD NOx Emissions Reduction Projections through 2020

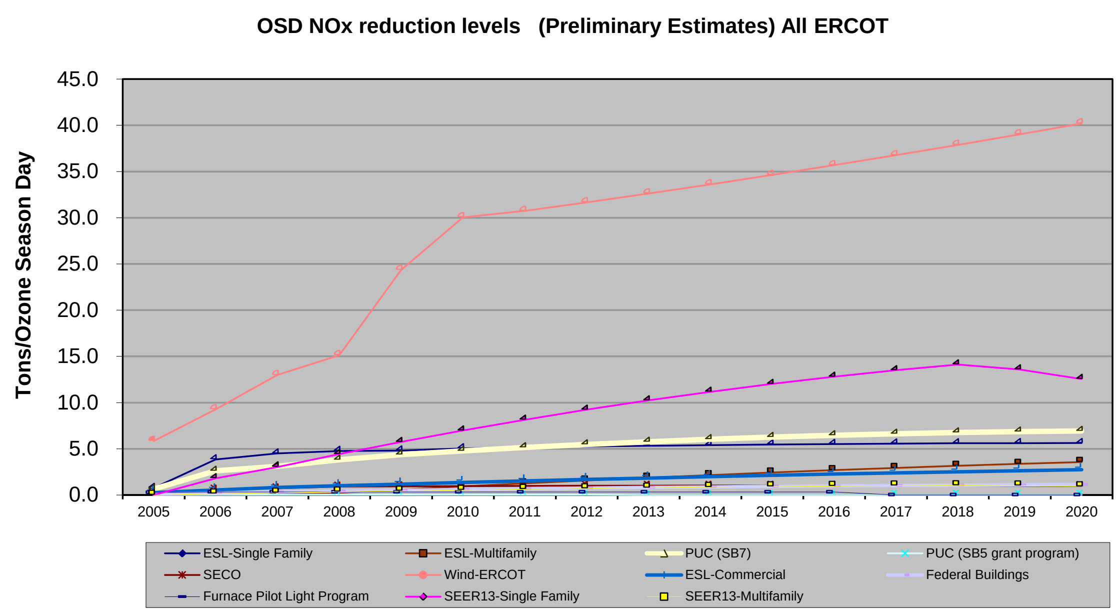


Figure 3: Cumulative OSD NOx Emissions Reduction Projected through 2020

3.7 Technology for Calculating and Verifying Emissions Reduction from Energy Used in Buildings

In 2004 and 2005, the Laboratory developed a web-based Emissions Reduction Calculator, known as "*eCalc*," which contains the underlying technology for determining NOx emissions reduction from power plants that generate the electricity for the user[9]. The emissions reduction calculator is being used to calculate emissions reduction for consideration for SIP credits from energy efficiency and renewable energy programs in the TERP.

[9] eCalc reports NOx, SOx and CO2 emissions reduction from the US EPA eGRID database for power providers in the ERCOT region.

In 2007, the Laboratory enhanced the calculator to provide additional functions and usability, including:

- Renaming the product IC3 v2.0
- Enhanced the Laboratory's IECC/IRC Code-Traceable Test Suite for determining emissions reduction due to code and above-code programs;
- Enhanced web-based emissions calculator, including:
    - Use of the calculator to determine 15% above code residential and commercial options.
    - Gathered, cleaned and posted weather data archive for 17 NOAA stations;
    - Performed comparative testing of the calculator vs. other, non-web-based simulation programs;
    - Developed and tested radiant barrier simulation;
    - Using the web-based emissions calculator, started development of the derivative version Texas Climate Vision calculator for the City of Austin;
- Continued the development of verification procedures, including:
    - Completed the calibrated simulation of a high-efficiency office building in Austin, Texas;
    - Continued work to develop a calibrated simulation of an office building in College Station; and
    - Continued work to develop a calibrated simulation of a K-12 school in College Station;

In 2008, work on both web based calculators continued;

- Deployed IC3 v3.2 to handle a wider selection of single family building configurations (http://ic3.tamu.edu);
- Delivered TCV v1.0 to the City of Austin for their testing;
- Continued to operate the original eCalc;
- Supported modeling efforts by building enhanced tools for batch simulation;
- Provided training on both IC3 and TCV.

In 2009, IC3 developments included:

- A sister product, AIM was created for the State Comptroller's office.
- Usage statistics continue to climb.
- Updated to v3.6 which included 3 story houses, external cladding, more sophisticated ceiling/roof models, enhanced foundation modeling and the ability to copy projects

In 2010 there were several software updates including:

- IC3
    - 3.9.0 – Slab Insulation Support
    - 3.7.0 – 3.8.0 First Version of Multifamily Released along with numerous tweaks and fixes
    - 3.6.2 – New Building Model Integrated, Updated Artwork and Illustrations
- DDP
    - 1.7.05 – Added Heat Reject Recording for Electric and Gas
- Web Reports and Texas Building Registry
    - Registry 0.x – First versions of the Web Reports on TCV, eCalc, and IC3
    - Registry 1.0 – City and County Reports
    - Registry 1.1 – Cross-linked Reports for City and County
    - IC3 Reports 1.0 – Updated Certificate Reports which replace Registry 1.1 and evolve into the Texas Building Registry

3.8 IC3 Texas Building Registry (TBR)

3.8.1 Background

In 2008, the 81st Texas Legislature amended the Texas Administrative Code (TAC .§388.008, 2009) to develop a Registry of Above-Code homes. The Laboratory built the first version of the Registry in 2009. This preliminary version allowed The Laboratory to provide basic metrics on usage of the Laboratory's above code calculators, *IC3*[10] and *TCV*[11]. By running reports against the calculator's databases, The Laboratory could determine calculator usage by month for Texas' Cities and Counties. These reports allowed a better understanding of how builders were adopting the calculators across the State so the Laboratory could improve the calculators.

Figure 4 shows the Projects and Certificates issued each month since January 2009. A Project is a house plan, Certificates are printed reports given to the building official - assuming that the house is at or above code. In 2009, some users entered a basic floor plan and re-cycled it to generate more certificates. Figure 5 shows that more projects were entered (and presumably did not pass) than certificates created.

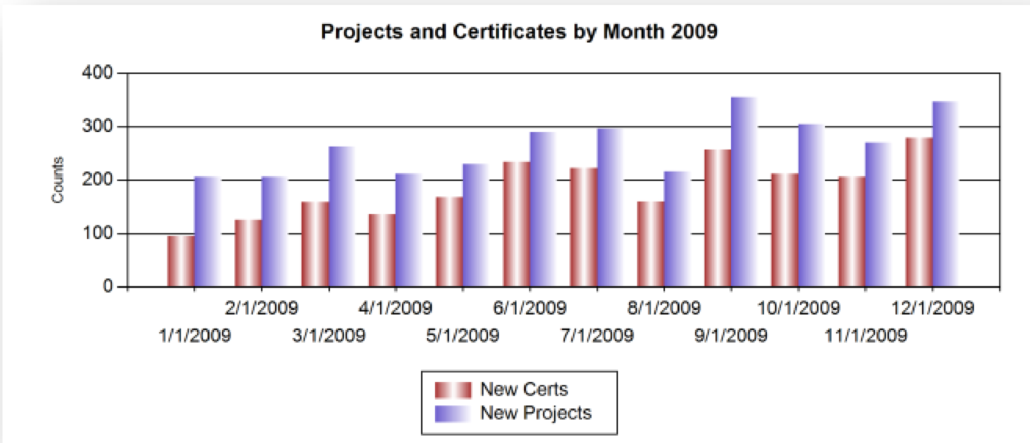


Figure 4: *IC3* 2009 Certificates and Projects

Figure 5 shows the cumulative Users and Certificates for 2009. The divergence between the two lines emphasizes the difference between the projects completed and certificates issued.

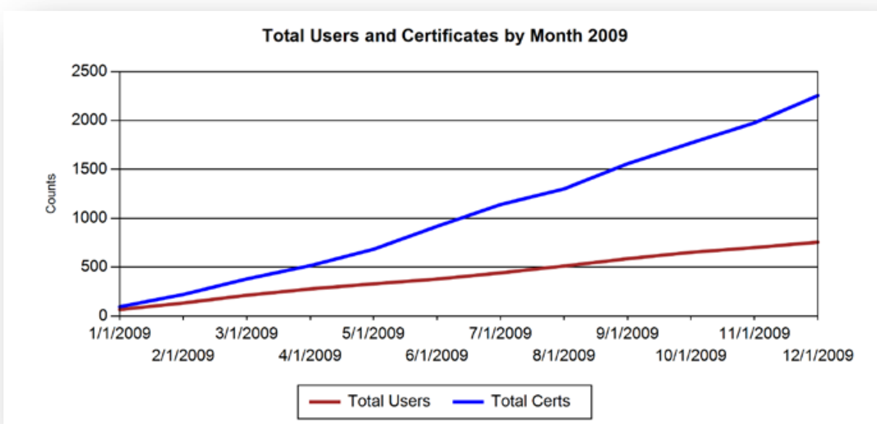


Figure 5: *IC3* 2009 Users vs. Certificates

[10] International Code Compliance Calculator, a web based, above code calculator for single family, detached, new construction in Texas.
[11] Texas Climate Vision, a web based, above code calculator for single family, detached, new construction in Austin Energy's service area.

Figure 6shows that the earliest adopter of the *IC3* software was the North Central Texas Council of Governments (NCTCOG) area, specifically, users building in Dallas, Collin, Denton, and Tarrant Counties.

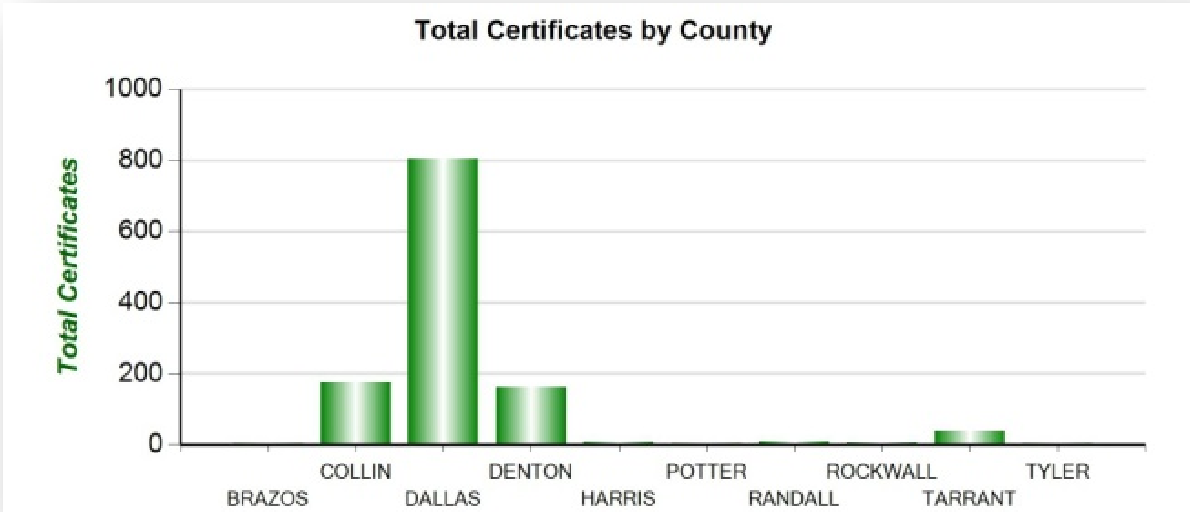


Figure 6: *IC3* 2009 Certificates - Top 10 Counties

Figure 7 shows the certifications issued by city (excluding Austin). Figure 4 shows that the City of McKinney led the way with 500 certificates, followed by the City of Dallas.

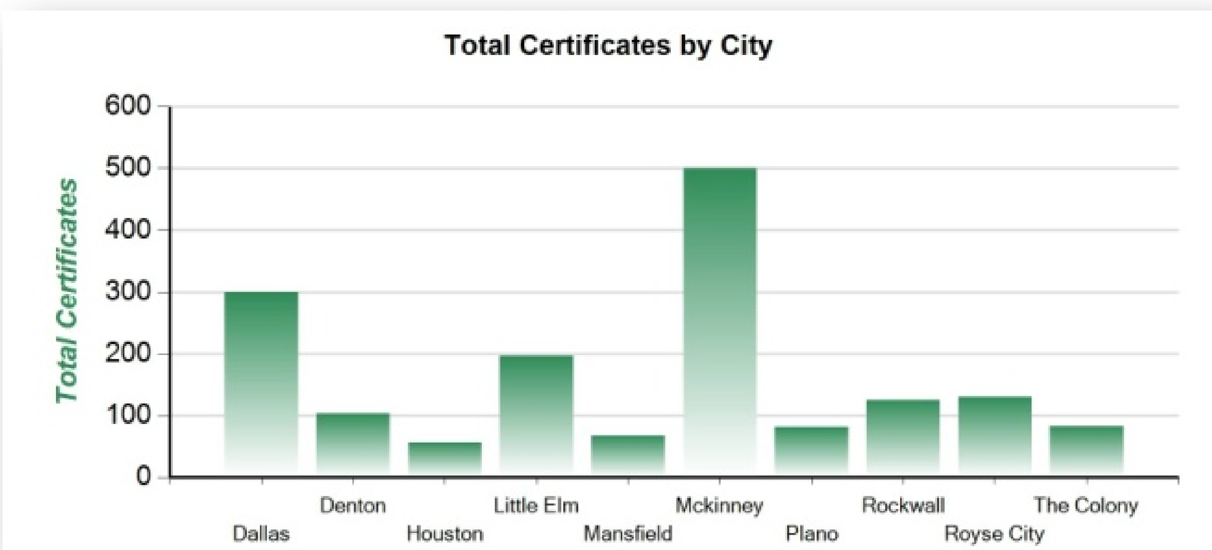


Figure 7: *IC3* 2009 Certificates - Top Ten Cities

3.8.2 TBR Current Version

As illustrated below and a "*Report on the Development of the Format for a Texas Residential Registry* (Gilman, et al., 2008), the underlying database was optimized for supporting the *IC3* and *TCV* calculators and therefore needed a transformation to allow for seamless reporting. Consequently, The Laboratory has been steadily adding reporting capability and has been making software changes to reflect the new reporting requirements and analysis capabilities. The underlying technology of the *IC3* and *TCV* calculators is *Microsoft SQL Server 2008*. This product offers reporting capabilities through various tools.

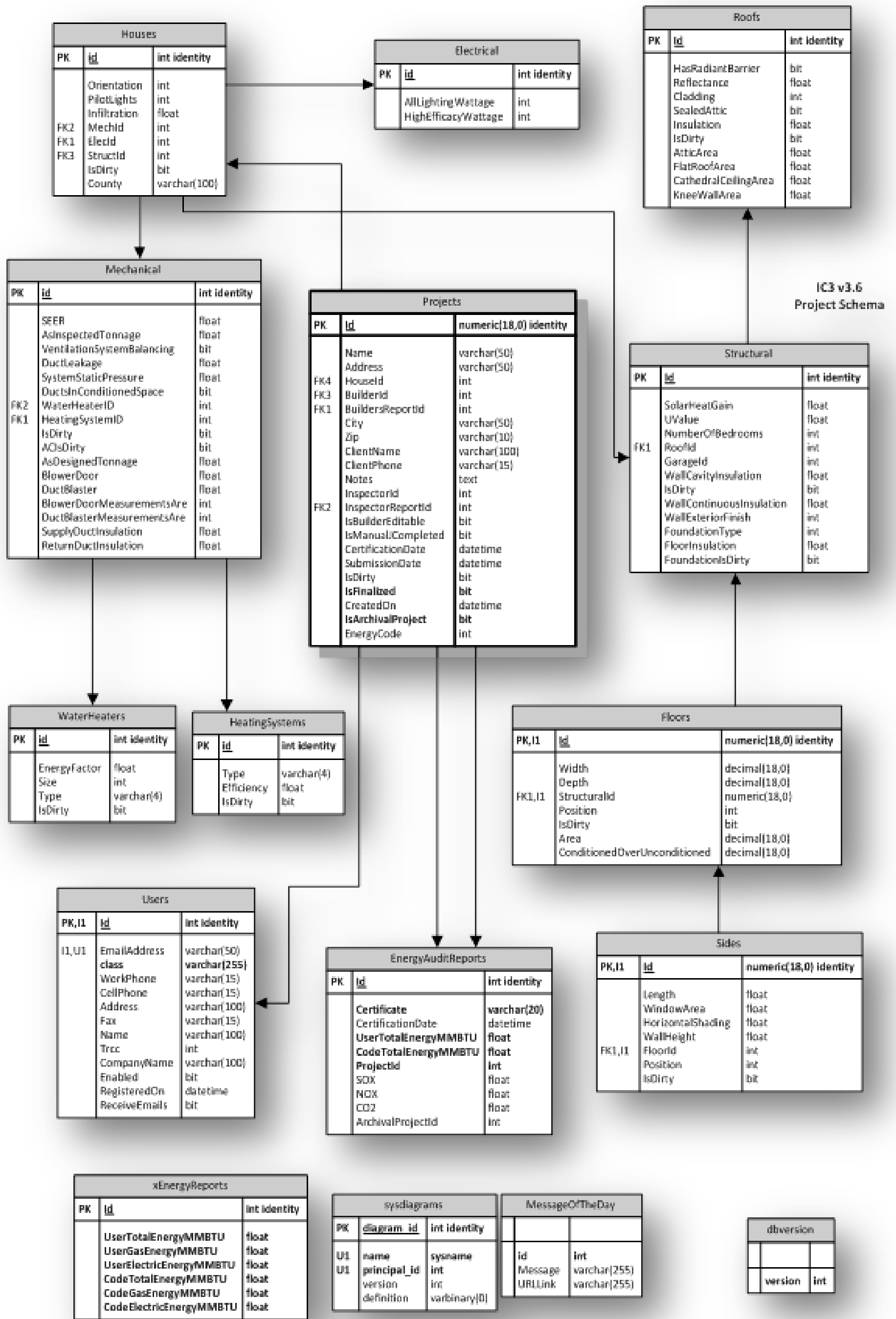


Figure 8 Database Schema

Figure 8 Database Schema shows the "layout" of the IC3 (v3.x) and TCV[12] (v1.1) databases. It gives a rough overview of the different tables (called "entities") found in the *IC3* database. The entities are linked together using "foreign keys" (the arrows) which allows the database to maintain a higher quality through "database integrity". The center entity is the Project, which is the center of the *IC3* software's abstraction of a house. The other tables are linked in via the foreign keys, which include floors, walls, electrical, and systems.

3.8.3 Usage Reports

Figure 9 shows a steady growth from the start of record keeping (July 2009) until the end of 2010. During this year, ESL conducted several workshops and was able to detect a correlation between workshops and IC3 usage.

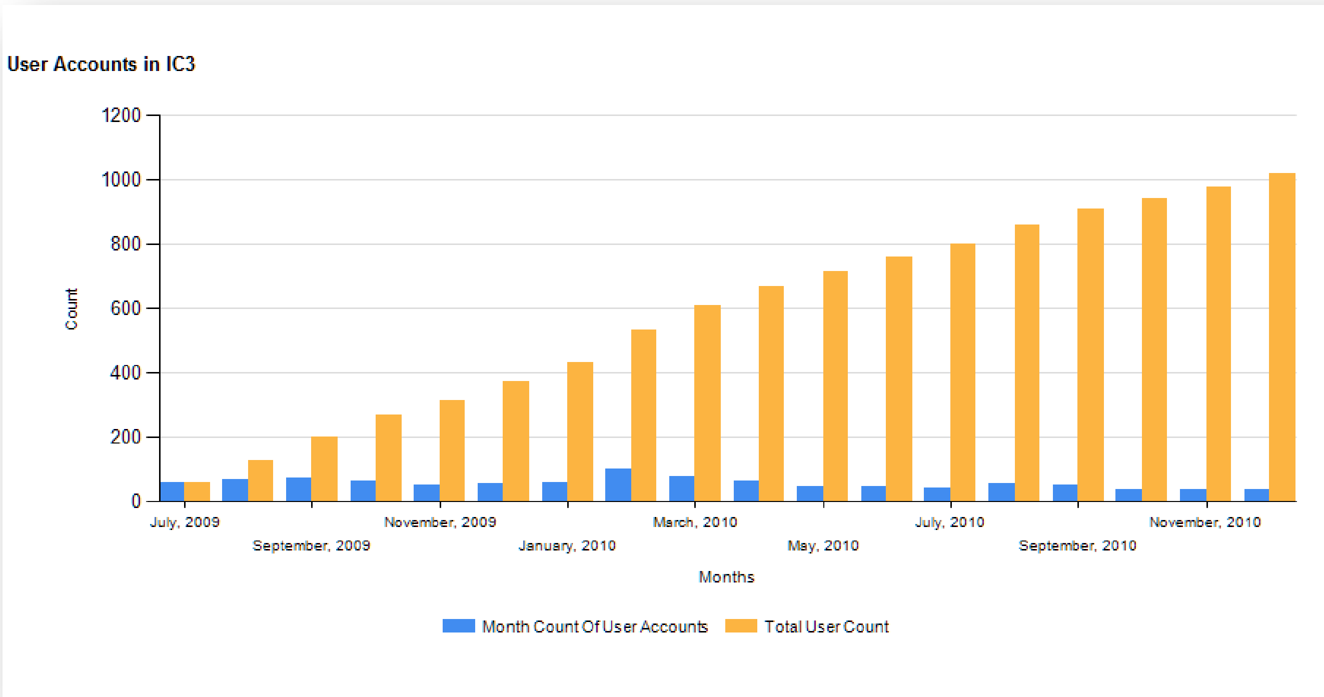


Figure 9: IC3 Usage Growth in 2010

Figure 10shows the correlation between users and their successful projects (i.e. those that generate certificates). The graph shows that users were generating more certificates, and were doing so at a much faster rate than the rate of adding new users.

[12] The *TCV* v1.1 database has different fields due to the built-in inspection module and the fact it was completed two years earlier than the described *IC3* v3.6.

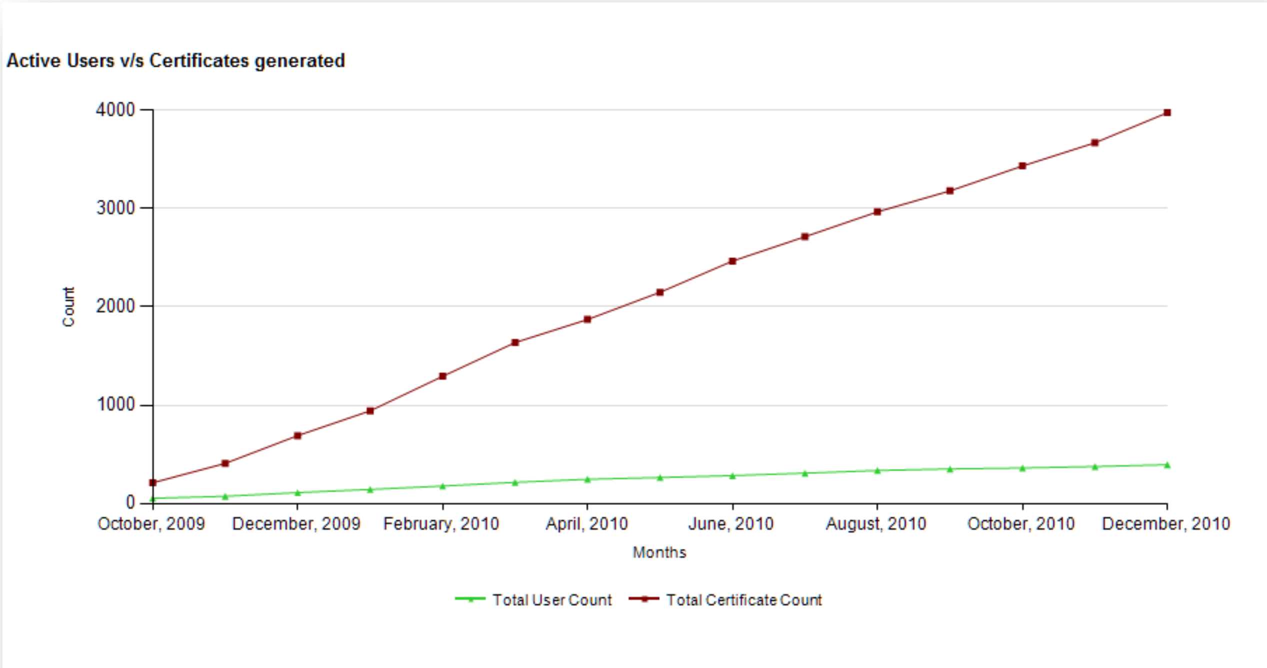


Figure 10 Users and Certificates 2010

Figure 11 and Figure 12 show where the biggest usage was using Counties as the grouping entity. The North Central Texas Council of Governments (NCTCOG) led the way in usage during 2010.

Top 10 Counties generating IC3 Certificates

	2010												
													Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
COLLIN	80	104	88	56	92	93	72	83	51	78	66	95	958
DALLAS	36	48	53	32	40	54	40	52	54	56	46	85	596
DENTON	54	91	82	56	66	69	56	34	38	47	51	46	690
HARRIS	15	24	26	16	14	38	26	13	6	18	10	18	224
HUNT	6	23	4	4	3	2	1				1	1	45
JOHNSON	4	3	11	8	3	6	4	7	8	6	3	9	72
RANDALL	4	11	5	5	4	1	1	3	7	11	7	5	64
ROCKWALL	11	11	6	21	23	21	14	22	9	6	10	21	175
TARRANT	25	22	39	21	20	22	23	23	20	16	21	19	271
WICHITA	5	7	19	2	2	2	3	6	2	4	1	1	54
Total	240	344	333	221	267	308	240	243	195	242	216	300	3149

Figure 11 Top 10 Counties for 2010

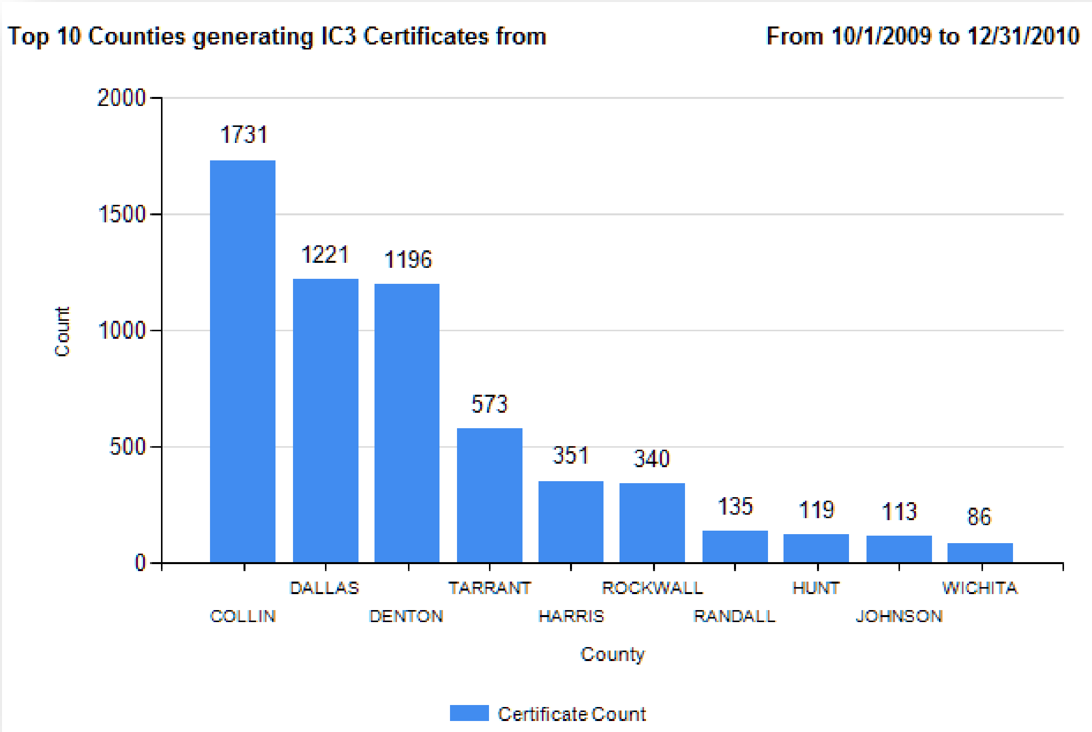


Figure 12 Top 10 Counties 2010

Figures 8 and 9 show where the biggest usage was using Counties as the grouping entity. The North Central Texas Council of Governments (NCTCOG) led the way in usage during 2010.

Top 10 Cities generating IC3 Certificates

	2010												
													Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Dallas	18	24	33	26	21	45	25	42	34	34	36	60	398
Denton	12	21	19	11	9	7	8	6	7	11	7	5	123
Flower Mound	6	7	14	11	12	15	6	4	8	9	3	9	104
Houston	14	24	23	15	10	35	26	14	6	17	10	18	212
Irving	13	16	10	2	11	4	4	7	6	12	6	4	95
Little Elm	18	36	36	17	29	28	21	13	11	11	24	19	263
Mckinney	43	79	57	32	43	60	42	48	27	43	38	64	576
Plano	40	15	29	26	44	30	22	27	19	35	21	16	324
Rockwall	11	7	6	18	16	14	9	21	8	4	9	14	137
Royse City	4	32	5	5	5	6	5	1		1		3	67
Total	179	261	232	163	200	244	168	183	126	177	154	212	2299

Figure 13: Top 10 Cities in 2010

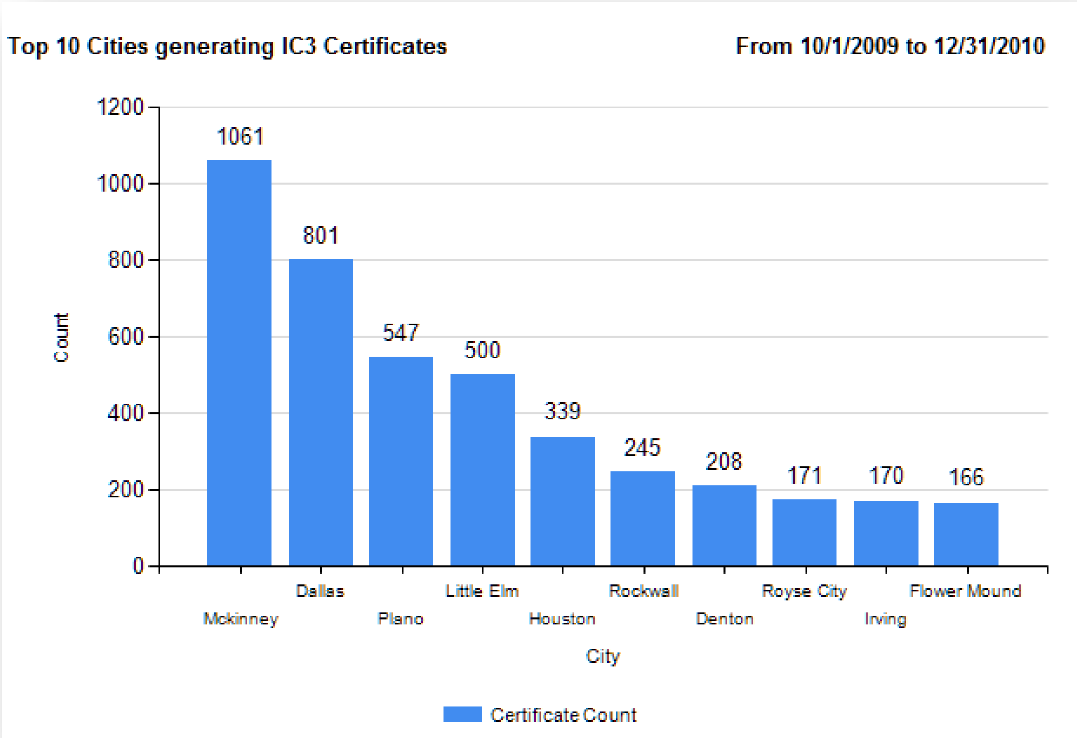


Figure 14: Top 10 Cities 2010

Not surprisingly, nine of ten top cities are in the NCTCOG.

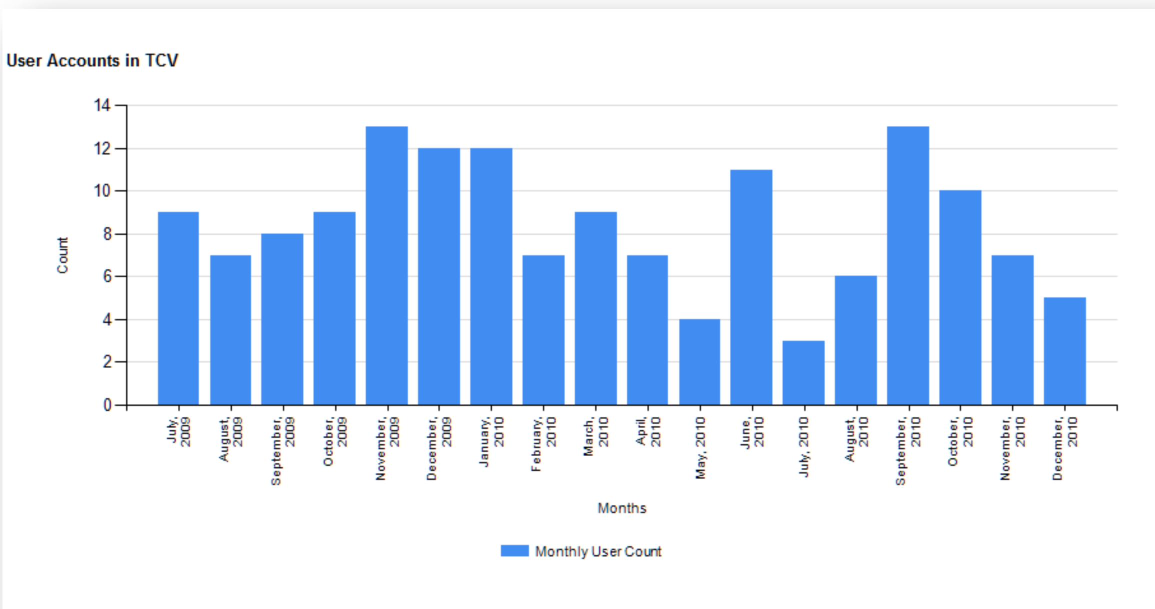


Figure 15: TCV Usage Growth in 2010

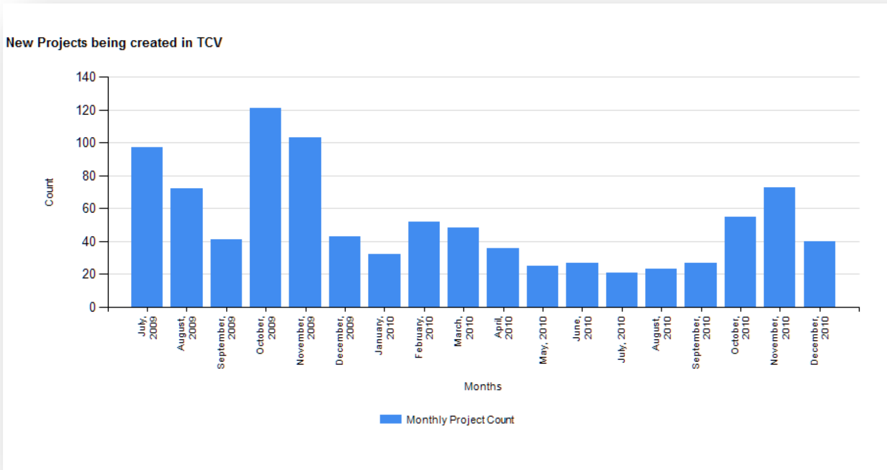
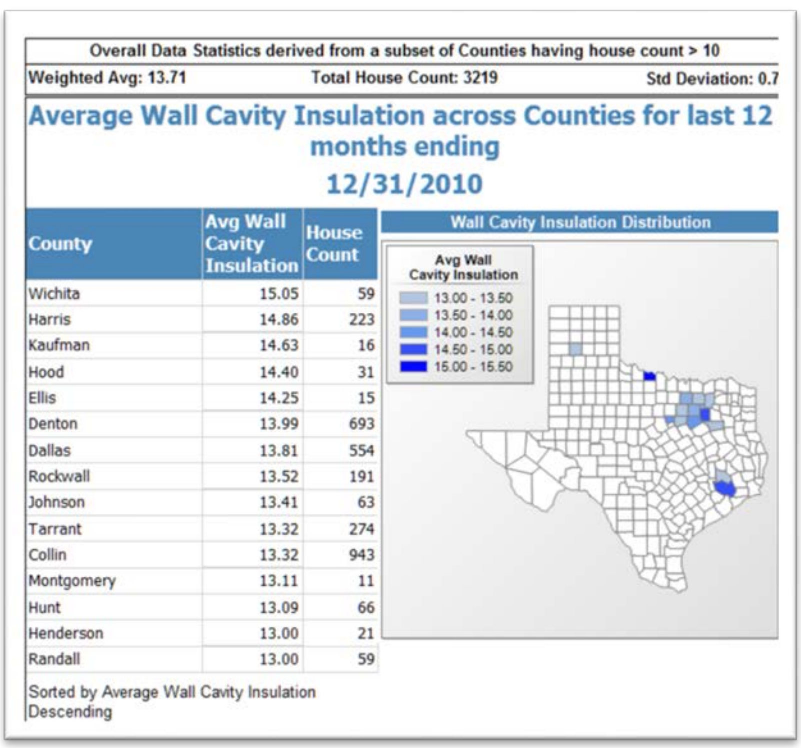


Figure 16: New Projects in TCV 2010

Figure 15and Figure 16 are a peek at how Austin/Travis county user and project activity faired in the latter part of 2009 and 2010. Austin's figures are separate as Austin paid for a modified version of the IC3 calculator and that means their data was kept separate in 2009 and 2010.

3.8.4 Parameter Reports

A unique and valuable use of the Registry is to look at building trends across the state.



Overall Data Statistics derived from a subset of Counties having house count > 10

Weighted Avg: 13.71 | Total House Count: 3219 | Std Deviation: 0.7

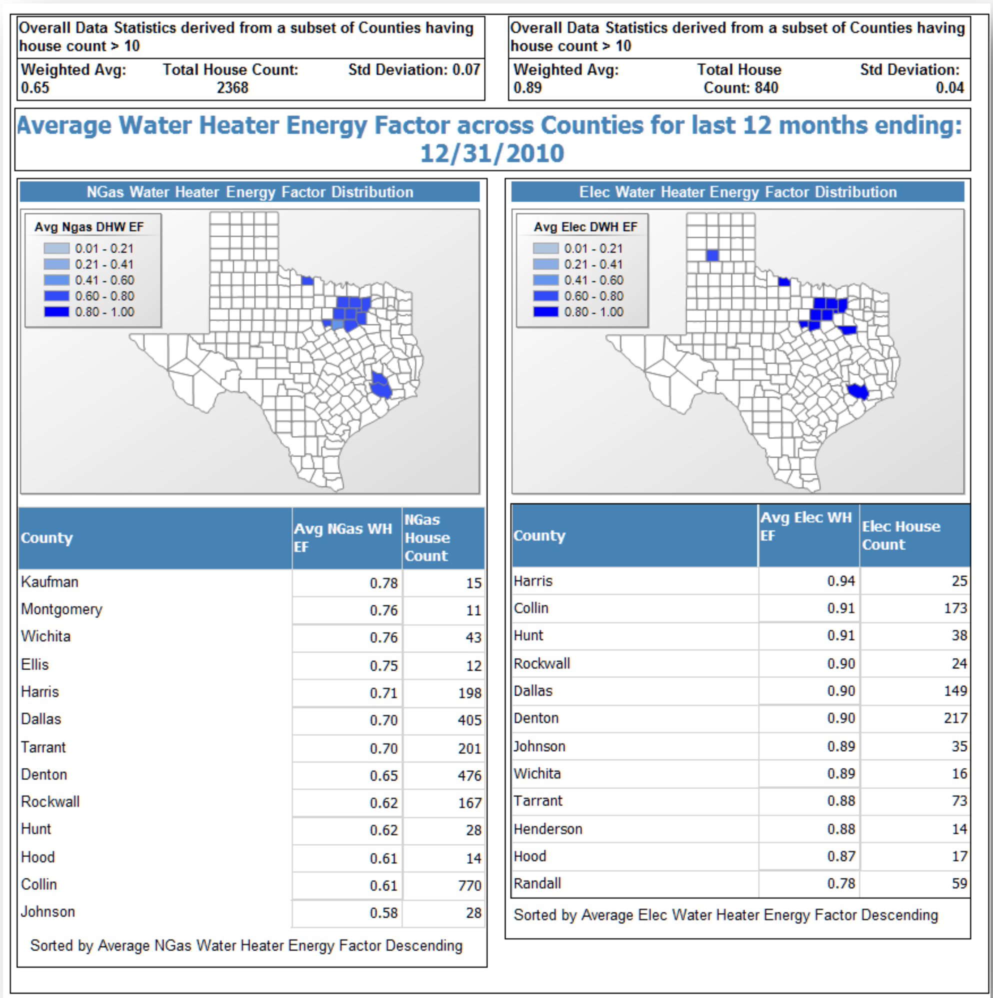
Average Wall Cavity Insulation across Counties for last 12 months ending 12/31/2010

County	Avg Wall Cavity Insulation	House Count
Wichita	15.05	59
Harris	14.86	223
Kaufman	14.63	16
Hood	14.40	31
Ellis	14.25	15
Denton	13.99	693
Dallas	13.81	554
Rockwall	13.52	191
Johnson	13.41	63
Tarrant	13.32	274
Collin	13.32	943
Montgomery	13.11	11
Hunt	13.09	66
Henderson	13.00	21
Randall	13.00	59

Sorted by Average Wall Cavity Insulation Descending

Figure 17: Average Wall Cavity Insulation by County 2010

Figure 17 shows how much insulation is used on a County basis during 2010 for the most active Counties. Values range from 13 to 15 with the values near 14 being the most common and 13.7 being the weighted average.



County	Avg NGas WH EF	NGas House Count
Kaufman	0.78	15
Montgomery	0.76	11
Wichita	0.76	43
Ellis	0.75	12
Harris	0.71	198
Dallas	0.70	405
Tarrant	0.70	201
Denton	0.65	476
Rockwall	0.62	167
Hunt	0.62	28
Hood	0.61	14
Collin	0.61	770
Johnson	0.58	28

Sorted by Average NGas Water Heater Energy Factor Descending

County	Avg Elec WH EF	Elec House Count
Harris	0.94	25
Collin	0.91	173
Hunt	0.91	38
Rockwall	0.90	24
Dallas	0.90	149
Denton	0.90	217
Johnson	0.89	35
Wichita	0.89	16
Tarrant	0.88	73
Henderson	0.88	14
Hood	0.87	17
Randall	0.78	59

Sorted by Average Elec Water Heater Energy Factor Descending

Figure 18 Average Water Heater Efficiencies 2010

This report shows both natural gas and electric water heater efficiencies across Texas in 2010. There are 2300 natural gas projects vs 800 electric projects. In addition, it is noted that the stated efficiencies are lower for natural gas than for electric, with the mean of natural gas appearing to be .70 (weighted average of .65) and the mean for electric at .90 (weighted average of .89).

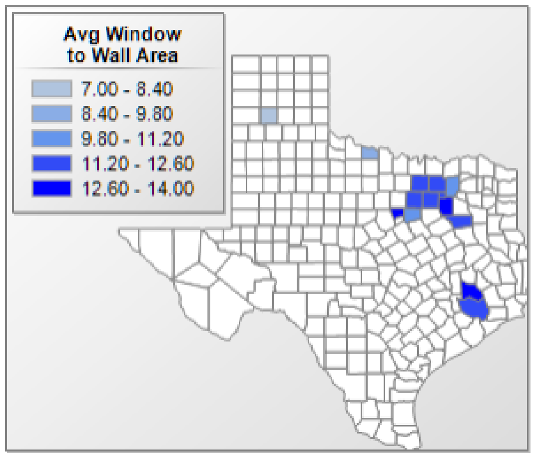
Overall Data Statistics derived from a subset of Counties having house count > 10

Weighted Avg: 11.69 **Total House Count: 3219** **Std Deviation: 1.78**

Average Window to Wall Area Ratio across Counties for last 12 months ending 12/31/2010

County	Avg Window To Wall Area	House Count
Ellis	14.63	14
Kaufman	13.05	15
Montgomery	12.87	15
Hood	12.76	46
Henderson	12.33	24
Tarrant	12.09	357
Denton	12.08	598
Dallas	12.03	812
Rockwall	11.85	166
Harris	11.78	154
Collin	11.46	916
Johnson	11.08	74
Hunt	10.00	35
Wichita	9.73	34
Randall	7.34	97

Window to Wall Area Ratio Distribution



Sorted by Average Window to Wall Area Ratio Descending

Figure 19 Average Window To Wall Ration 2010

Here is an analysis of the window to wall ratio across Texas in 2010. The mean is approximately a 12 ratio, with a weighted average of 11.7.

Overall Data Statistics derived from a subset of Counties having house count > 10

Weighted Avg: 14.06 **Std Deviation: 0.52** **Total House Count: 3219**

Average A/C SEER across Counties for the last 12 months ending: 12/31/2010

County	Avg A/C SEER	House Count
Wichita	15.2	59
Hood	14.6	31
Harris	14.4	223
Henderson	14.2	21
Tarrant	14.1	274
Hunt	14.1	66
Ellis	14.1	15
Dallas	14.1	554
Montgomery	14.1	11
Collin	14.0	943
Johnson	14.0	63
Rockwall	14.0	191
Denton	14.0	693
Kaufman	13.1	16
Randall	13.0	59

Sorted by Average A/C SEER Descending

A/C SEER Distribution

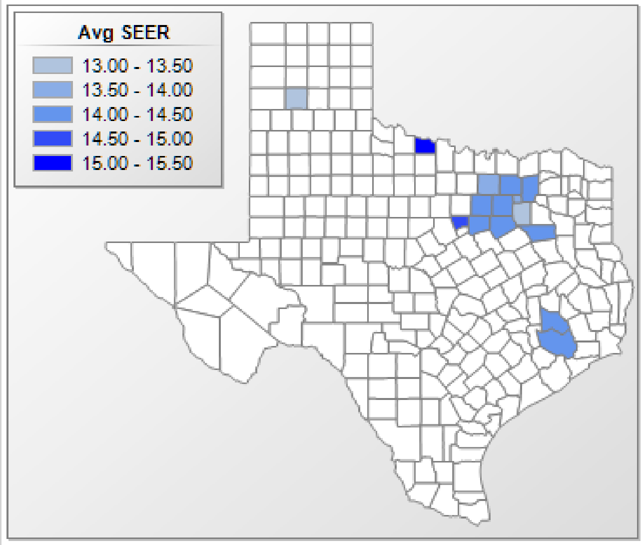


Figure 20 Average SEER 2010

The efficiency (and sizing) of air conditioning is a vital component of energy efficiency in Texas. Here we see 14.1 as the mean and weighted average. The law required SEER 13 in 2010, so it appears that HVAC efficiency is a common way to boost efficiency.

Overall Data Statistics derived from a subset of Counties having house count > 10

Weighted Avg: 34.08 | **Std Deviation: 2.08** | **Total House Count: 3219**

Average Ceiling Insulation across Counties for last 12 months ending: 12/31/2010

County	Avg Ceiling Insulation	House Count
Wichita	35.70	59
Rockwall	35.45	191
Hunt	35.20	66
Randall	35.12	59
Collin	34.84	943
Hood	34.68	31
Denton	34.55	693
Johnson	33.89	63
Dallas	33.81	554
Kaufman	32.00	16

Top 10 Counties, sorted by Average Ceiling Insulation Descending

Ceiling Insulation Distribution

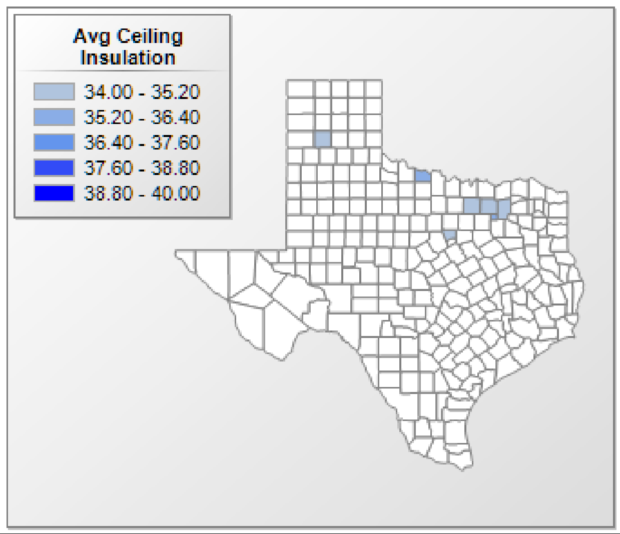


Figure 21 Average Ceiling Insulation 2010

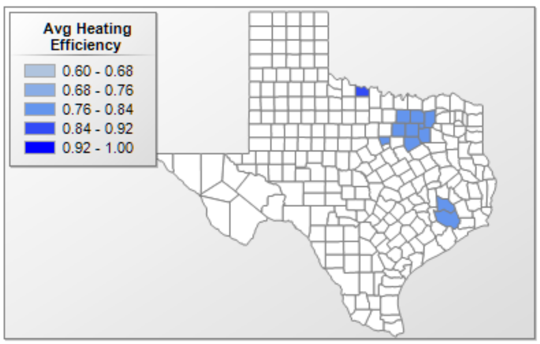
Here we see the counties with the highest ceiling insulation, interesting to note they are all in North Texas and are R32 on up, with a weighted average of R 34.

Overall Data Statistics derived from a subset of Counties having house count > 10		
Weighted Avg: 0.81	Total House Count: 2361	Std Deviation: 0.03

Overall Data Statistics derived from a subset of Counties having house count > 10		
Weighted Avg: 8.49	Total House Count: 701	Std Deviation: 0.47

Average Heating Efficiency across Counties for last 12 months ending: 12/31/2010

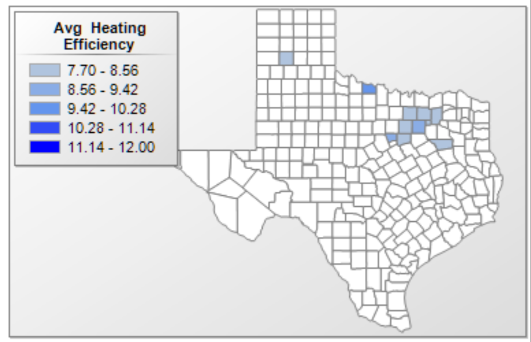
Natural Gas Heating Efficiency Distribution



County	Avg Heating Efficiency	House Count
Wichita	0.91	41
Harris	0.84	198
Hood	0.84	12
Ellis	0.83	13
Tarrant	0.81	190
Dallas	0.80	411
Collin	0.80	793
Rockwall	0.80	167
Denton	0.80	483
Hunt	0.80	28
Montgomery	0.80	11
Kaufman	0.80	14

Sorted by Average NGas Heating Efficiency Descending

Heat Pump Heating Efficiency Distribution



County	Avg Heating Efficiency	House Count
Wichita	9.57	15
Dallas	9.19	99
Hood	8.69	18
Randall	8.54	59
Tarrant	8.53	55
Rockwall	8.38	21
Denton	8.34	183
Collin	8.31	148
Hunt	8.29	37
Henderson	8.12	13
Johnson	7.96	53

Sorted by Average HPump Heating Efficieny Descending

Figure 22 Average Heating Efficiency 2010

Here we examine space heating efficiency in 2010 using both natural gas and electric heat. Natural gas has a mean of .80 and a weighted average of .81, while electric is at 8.38 with a weighted average of 8.49. It is also interesting to note that the Heat Pumps are all in north Texas.

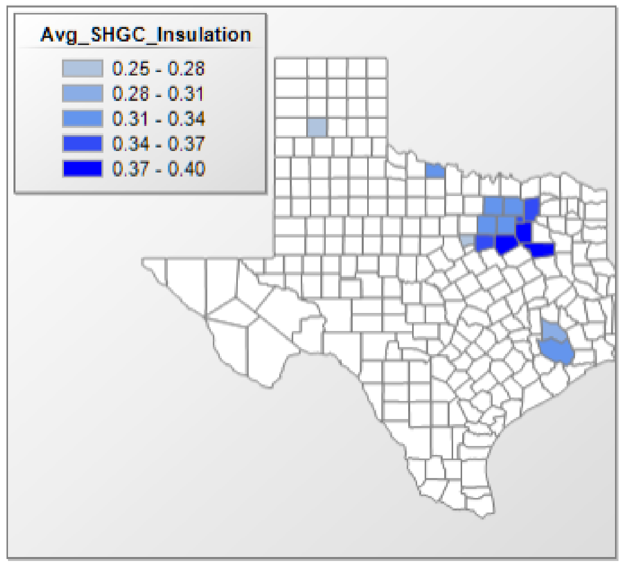
Overall Data Statistics derived from a subset of Counties having house count > 10

Weighted Avg: 0.329 **Total House Count: 3219** **Std Deviation: 0.034**

Average SHGC across Counties for last 12 months ending 12/31/2010

County	Avg SHGC	House Count
Henderson	0.39	21
Kaufman	0.37	16
Ellis	0.37	15
Hunt	0.35	66
Johnson	0.35	63
Rockwall	0.34	191
Tarrant	0.33	274
Collin	0.33	943
Harris	0.33	223
Denton	0.33	693
Dallas	0.32	554
Wichita	0.31	59
Montgomery	0.30	11
Randall	0.27	59
Hood	0.27	31

SHGC Distribution



Sorted by Average SHGC Descending

Figure 23 Average SHGC 2010

The efficiency of the glass is tightly clustered around .33 for most counties in Texas.

Overall Data Statistics derived from a subset of Counties having house count > 10

Weighted Avg: 535.59 Total House Count: 3219 Std Deviation: 50.51

Average HVAC across Counties for last 12 months ending 12/31/2010

County	Avg Sqft HVAC Tonnage	House Count
Ellis	662	15
Kaufman	601	16
Tarrant	578	274
Wichita	554	59
Hood	540	31
Johnson	539	63
Montgomery	538	11
Denton	536	693
Collin	535	943
Rockwall	535	191
Randall	532	59
Dallas	530	554
Harris	504	223
Hunt	494	66
Henderson	431	21

Sorted by Average Sqft HVAC Tonnage Descending

Sqft HVAC Tonnage Distribution

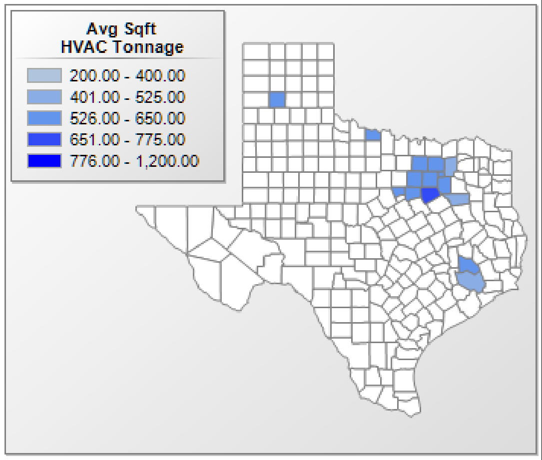


Figure 24 Average HVAC Tonnage to Sq Ft 2010

Another way to evaluate high performing houses is how much air conditioning they have per sq ft of house. Here we see ranges of 431 to 662 sq ft per ton with a mean of 538 just north of Houston and a weighted average of 535 sq ft per ton. The old rule of thumb was 500 sq ft per ton. Thus, Texas is becoming more efficient.

Overall Data Statistics derived from a subset of Counties having house count > 10

Weighted Avg: 0.41 | Total House Count: 3219 | Std Deviation: 0.05

Average U Factor across Counties for last 12 months ending 12/31/2010

County	Avg U Factor	House Count
Henderson	0.52	21
Kaufman	0.48	16
Ellis	0.47	15
Johnson	0.44	63
Tarrant	0.44	274
Rockwall	0.42	191
Denton	0.42	693
Hunt	0.41	66
Collin	0.41	943
Dallas	0.41	554
Harris	0.40	223
Wichita	0.39	59
Montgomery	0.36	11
Hood	0.33	31
Randall	0.32	59

Sorted by Average U Factor Descending

U Factor Distribution

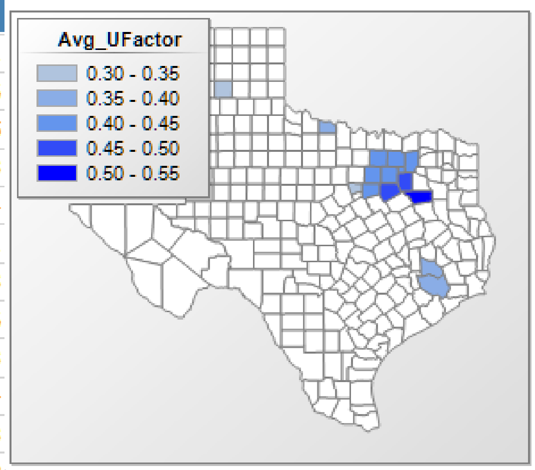


Figure 25 Average U Factor 2010

The U-Factor applies to the heat transfer of a window caused by temperature, not direct solar radiation. Here, we see the most common value being .41.

3.9 Code Adoption

During the 77th Legislature, Senate Bill 5 (SB 5) adopted the 2000 International Residential Code (IRC) as the energy code for single-family residential construction and the 2000 International Energy Conservation Code (IECC), with the 2001 Supplement for all other residential, commercial and industrial construction in the state. This bill became law in 2001 and marks the first mandatory energy code requirements for the State of Texas and establishes the Texas Building Energy Performance Standards (TBEPS). Both codes require that municipalities establish procedures for administration and enforcement, and ensure that code-certified inspectors perform inspections.

State adoption of the 2000 Residential Code energy provisions and 2000 International Energy Conservation Code became effective September 1, 2001. A recent survey conducted by the Energy Systems Laboratory (ESL) indicates adoption of more recent editions of the International Energy Conservation Code (IECC), including the 2003, 2006, and 2009 editions; see tables below

Table 2: Code adoptions

CITY NAME	Commercial Building Code (IBC)	Residential Building Code (IRC)	Energy Code (IECC)	Electrical Code (NEC)	Mechanical Code (IMC)	Plumbing Code (IPC)	Green Building Code	Existing Building Code (IEBC)	Other Codes
Abilene	2003	2003	2000	2008	2003	2003	N/A	2003	2003 IFGC
Addison									
Allen									
Amarillo	2006	2006	2006	2008	2006	2006	N/A	2006	2006 IFC, 2006 IFGC
Angleton									
Arlington	2003	2003	2003	2002	2003	2003	N/A	N/A	2003 IFC, 2003 IFGC
Austin									
Baytown	2006	2006	2006	2008	2006	2006	N/A	2006	N/A
Beaumont									
Bedford									
Big Spring	2006	2006	2006	2005	2006	2006	N/A	2006	N/A
Borger									
Brownsville	2006	2006	2006	2008	2006	2006	N/A	N/A	2006 IFGC
Bryan	2003	2003	2003	2002	2003	2003	N/A	2003	2003 IFGC
Burleson	2006	2006	2006	2005	2006	2006	N/A	N/A	North Central Texas Council of Government Amendment
Carrollton *	2006	2006	2006	2008	2006	2006	N/A	N/A	NCTCOG Recommended Regional Amendments
Cedar Hill	2006	2006	2006	2008	2006	2006	N/A	N/A	2006 IFGC
Cedar Park	2009	2009	2009	2008	2009	2009	N/A	2009	2006 IFC with Ammendments, 2009 IPMC
Cleburne	2003	2003	2003	2002	2003	2003	N/A	N/A	N/A
College Station	2009	2009	2009	2008	2009	2009	N/A	N/A	N/A
Conroe	2003	N/A	N/A	2008	2000	2000	N/A	N/A	2003 IFC
Coppell	N/A	2006	2006	2005	2006	2006	N/A	2006	2006 IFC, 2006 IFGC, 2006 IPMC
Copperas Cove									
Corpus Christi	2003	2003	2003	2002	2003	2003	N/A	N/A	N/A
Corsicana	2009	2009	N/A	2008	2009	2009	N/A	N/A	N/A
Dallas	2006	2006	2006	2008	2006	2006	City of Dallas Ordinance #081070	2003	2006 IFC, 2006 IFGC
Deer Park									
Del Rio									
Denton									

CITY NAME	Commercial Building Code (IBC)	Residential Building Code (IRC)	Energy Code (IECC)	Electrical Code (NEC)	Mechanical Code (IMC)	Plumbing Code (IPC)	Green Building Code	Existing Building Code (IEBC)	Other Codes
Desoto	2003	2003	2003	2002	2003	2003	N/A	N/A	N/A
Devine									
Duncanville	2008	2008	2008	2008	2008	2008	N/A	N/A	2006 IFGC, 2006 IPMC
Eagle Pass	2009	2009	2009	2008	2006	2009	N/A	2006	N/A
Edinburg									
El Paso									
Euless	2003	2003	2003	2002	2003	2003	N/A	N/A	2003 IFC, 2003 IFGC, 2003 IPMC
Farmers Branch									
Flower Mound									
Fort Worth	2003	2003	2003	2008	2003	2003	N/A	N/A	2003 IFGC
Friendswood	2009	2009	2009	2008	2009	2009	N/A	N/A	N/A
Frisco									
Galveston	2009	2009	2009	2008	2009	2009	N/A	N/A	2009 IFC, 2009 IPMC
Garland	2003	2003	2003	2005	2003	2003	N/A	N/A	N/A
Georgetown	2003	2000	2000	2002	2003	2003	N/A	2003	N/A
Grand Prairie	2003	2003	2003	2005	2003	2003	N/A	N/A	2003 IFC, 2003 IFGC
Grapevine	2006	2006	Referenc	2005	2006	2006	N/A	2006	N/A
Greenville	2006	2006	2006	2005	2006	2006	N/A	2006	N/A
Haltom City	2003	2003	2003	2002	2003	2003	N/A	N/A	N/A
Harker Heights	2009	2009	2008	2008	2009	2009	N/A	2006	2009 IFC, 2009 IFGC
Harlingen									
Houston									
Huntsville	2003	2003	2003	2005	2003	2003	N/A	N/A	2003 IFC, 2003 IFGC, 2003 IPMC
Hurst	2003	2003	2003	2005	2003	2003	N/A	N/A	2003 IPMC
Irving	2006	2006	2006	2008	2006	2006	N/A	N/A	2006 IFC, 2006 IFGC
Keller	2006	2006	2006	2008	2006	2006	N/A	N/A	2006 IFGC
Killeen									
Kingsville									
Kyle	2000	2000	2000	1999	2000	2000	N/A	N/A	2000 IPMC
La Porte									
Lake Jackson									
Lancaster	2003	2003	2003	2002	2003	2003	N/A	N/A	2003 IPMC

CITY NAME	Commercial Building Code (IBC)	Residential Building Code (IRC)	Energy Code (IECC)	Electrical Code (NEC)	Mechanical Code (IMC)	Plumbing Code (IPC)	Green Building Code	Existing Building Code (IEBC)	Other Codes
Laredo	2009	2009	2009	2008	2009	2009	N/A	2009	N/A
League City	2006	2006	2006	2005	2006	2006	N/A	2006	N/A
Leander	2009	2009	2009	2008	2009	2009	N/A	2009	N/A
Lewisville	2006	2006	2006	2005	2006	2006	N/A	N/A	North Texas Regional Council of Governments Amendments to International Codes
Longview									
Lubbock									
Lufkin	2006	2006	N/A	2005	2006	2006	N/A	2006	N/A
Mansfield	2006	2006	2006	2005	2006	2006	N/A	N/A	2006 IFGC
McAllen	2006	2006	2006	2008	2006	2006	N/A	N/A	2006 IFGC
McKinney	2006	2006	2006	2005	2006	2006	N/A	N/A	N/A
Mesquite									
Midland	2009	2009	2009	2008	2009	2009	N/A	N/A	N/A
Mission									
Missouri City	2006	2006	2006	2005	2006	2006	N/A	N/A	2006 IPMC
Nacogdoches	2006	2006	2006	2005	2006	2006	N/A	N/A	2006 IFC
New Braunfels	2006	2006	2006	2005	2006	2006	N/A	2006	2006 IFC, 2006 IPMC
North Richland									
Odessa									
Paris									
Pasadena	2006	2006	2006	2008	2006	2006	N/A	N/A	2006 IPMC
Pearland	2006	2006	2006	2005	2006	2006	dinance, NO MOD	2006	2006 IPMC
Pflugerville									
Pharr	2003	2003	2009	2002	2003	2003	N/A	2003	2003 IFC, 2003 IPMC
Plano									
Port Arthur	2006	2006	2006	2002	2006	2006	N/A	1997	N/A
Richardson	2006	2006	2006	2005	2006	2006	N/A	N/A	N/A
Rockwall	2006	2006	2006	2005	2006	2006	N/A	N/A	2006 IFC
Rosenberg									
Round Rock	2006	2006	2006	2008	2006	2006	N/A	2006	N/A
Rowlett									
San Angelo									
San Antonio									
San Benito	2009	2009	2009	N/A	2009	2009	N/A	N/A	2009 IFGC, 2009 IPMC, 2009 IWUIC
San Juan	2006	2006	2006	2008	2006	2006	N/A	2006	2006 IFC/Hurricane Resistant Residential Construction
San Marcos									
Schertz									
Seguin	2006	2006	2006	2005	2006	2006	N/A	2006	N/A
Sherman	2006	2006	2006	2005	2006	2006	N/A	N/A	N/A
Socorro	2003	2003	2003	2003	2003	2003	2003	2003	N/A
Southlake	2006	2006	2006	2008	2006	2006	N/A	N/A	N/A
Sugar Land	2003	2003	2003	2005	2003	2003	N/A	2003	2003 IFC, 2003 IFGC, 2003 IPMC
Temple	2006	2006	2006	2008	2006	2006	N/A	N/A	2006 IFGC, 2006 IPMC
Texarkana									
Texas City	2006	2006	2006	2006	2006	2006	2006	2006	N/A
The Colony	2006	2006	2006	2008	2006	2006	N/A	N/A	N/A
Tyler									
Victoria									
Waco *	2009	2009	2009	2008	2009	2009	N/A	2009	2009 IFC, 2009 IFGC, 2009 IPMC
Waxahachie									
Weatherford									
Weslaco									
Wichita Falls	2006	2006	2006	2008	2006	2006	N/A	2006	N/A

In general, the State has enjoyed a true market transformation in the supply of certain products, such as Low Solar Gain windows[13].

Section 388.009 of HB 3235 requires the Laboratory to develop and administer a state-wide training program for municipal building inspectors who seek to become code-certified inspectors. To accomplish this, the Laboratory originally developed the Energy Code Workshops which were based on the 2006 International Energy Conservation Code (IECC) as published by the International Code Council (ICC) for residential and commercial buildings, with amendments. During 2010, the Laboratory provided various energy-code-related trainings through projects funded by the State Energy Conservation Office, which began in previous years. These included:

[13] http://www.energycodes.gov/implement/pdfs/shgc.pdf

- Residential and Commercial Energy Code Training;
- Green is Mainstream: Energy Codes, Energy Efficiency, and Best Practices in Green Building Workshops; and
- International Code Compliance Calculator (IC3) Workshops.

In addition, in April 2010, the Laboratory was awarded a grant from the Texas Workforce Commission for a project that included:

- Developing five curricula related to the 2009 IECC and EE/RE topics (in carpentry, electrical, HVAC, plumbing, and a cross-trades basic technician level), which were submitted (in 2011) to the Texas Higher Education Coordinating Board (THECB) for consideration for inclusion in the Workforce Education Course Manual (WECM) as credit-hour coursework and/or certification courses; and
- Developing six short courses on the 2009 IECC and teaching them through workshops across Texas.

These included three levels of 2009 IECC Overview courses (Basic, Intermediate and Advanced), and three hands-on technical skills training (Special Topic Hands-on: Performance Testing Requirements in the Code, Special Topic Hands-on: Duct Total Leakage Testing at Rough-in, Special Topic Hands-on: Air Infiltration Testing & Duct Leakage to Outside). During 2010, all the various programs included a total of 49 short courses/workshops conducted in 2010, with a total of 818 participants.

Table 3: List of all short courses/workshops conducted in 2010

Short Courses/Workshops			
Course Title	**Date**	**Location**	**Attendance**
IECC 2009 Fundamentals Commercial	1/29/2010	Waco, TX	12
IECC 2009 Fundamentals Residential	1/29/2010	Waco, TX	12
IECC 2009 Fundamentals Commercial	2/2/2010	Corpus Christi, TX	15
IECC 2009 Fundamentals Residential	2/2/2010	Corpus Christi, TX	11
Overview of International Code Compliance Calculator	2/3/2010	Corpus Christi, TX	16
IECC 2009 Fundamentals Commercial	2/3/2010	Corpus Christi, TX	9
Overview of International Code Compliance Calculator	2/4/2010	Corpus Christi, TX	8
IECC 2009 Fundamentals Residential	2/4/2010	Corpus Christi, TX	11
IECC 2009 Fundamentals Commercial	2/9/2010	Waco, TX	36
IECC 2009 Fundamentals Residential	2/9/2010	Waco, TX	45
Overview of International Code Compliance Calculator	2/10/2010	Waco, TX	17
Green Is Mainstream	2/25/2010	San Angelo, TX	12
Green Is Mainstream	3/5/2010	Tyler, TX	13
Green Is Mainstream	3/20/2010	Victoria, TX	7
Green Is Mainstream	3/30/2010	Laredo, TX	14
Green Is Mainstream	4/6/2010	Abilene, TX	21
Green Is Mainstream	4/13/2010	El Paso, TX	24
Green Is Mainstream	4/27/2010	Lubbock, TX	7
Green Is Mainstream	4/29/2010	Temple, TX	35
Green Is Mainstream	6/8/2010	Marble Falls, TX	11
Green Is Mainstream	6/17/2010	Nash, TX	7
Green Is Mainstream	6/29/2010	Kerrville, TX	9
Green Is Mainstream	7/14/2010	Houston, TX	24
Green Is Mainstream	7/14/2010	Houston, TX	19
Green Is Mainstream	7/22/2010	Midland, TX	10
2009 IECC Overview Basic	8/26/2010	Austin, TX	8

2009 IECC Overview Intermediate	8/26/2010	Austin, TX	13
2009 IECC Overview Advanced	8/26/2010	Austin, TX	10
Special Topic Hands-on: Performance Testing Requirements in the Code	8/26/2010	Austin, TX	11
2009 IECC Overview Basic	9/20/2010	Cedar Valley College, Lancaster, TX	11
2009 IECC Overview Intermediate	9/20/2010	Cedar Valley College, Lancaster, TX	15
Introductory Presentation on Proposed Certification Endorsements	9/20/2010	Cedar Valley College, Lancaster, TX	12
2009 IECC Overview Advanced	9/21/2010	Cedar Valley College, Lancaster, TX	8
Green is Mainstream	10/14/2010	Grapevine, TX	20
Green is Mainstream	10/21/2010	Longview, TX	8
Special Topic Hands-on: Duct Total Leakage Testing at Rough-in	10/26/2010	Cedar Valley College, Lancaster, TX	18
Special Topic Hands-on: Performance Testing Requirements in the Code	10/26/2010	Cedar Valley College, Lancaster, TX	20
Introductory Presentation on Proposed Certification Endorsements	10/27/2010	Cedar Valley College, Lancaster, TX	11
Special Topic Hands-on: Air Infiltration Testing & Duct Leakage to Outside	10/27/2010	Cedar Valley College, Lancaster, TX	17
Special Topic Hands-on: Duct Total Leakage Testing at Rough-in	10/28/2010	Cedar Valley College, Lancaster, TX	17
Special Topic Hands-on: Performance Testing Requirements in the Code	10/28/2010	Cedar Valley College, Lancaster, TX	20
Special Topic Hands-on: Air Infiltration Testing & Duct Leakage to Outside	10/29/2010	Cedar Valley College, Lancaster, TX	17
2009 IECC Overview Basic	11/1/2010	Plano, TX	29
2009 IECC Overview Basic	11/1/2010	Plano, TX	3
2009 IECC Overview Intermediate	11/1/2010	Plano, TX	23
2009 IECC Overview Advanced	11/2/2010	Plano, TX	19
2009 IECC Overview Intermediate	11/2/2010	Plano, TX	8
Green is Mainstream	12/3/2010	Houston, TX	74
Green is Mainstream	12/10/2010	Bryan, TX	21
TOTAL: 49 Short Courses/Workshops were conducted in 2010, with a total of 818 participants			

These slides are from the IC3 Workshops. These were given

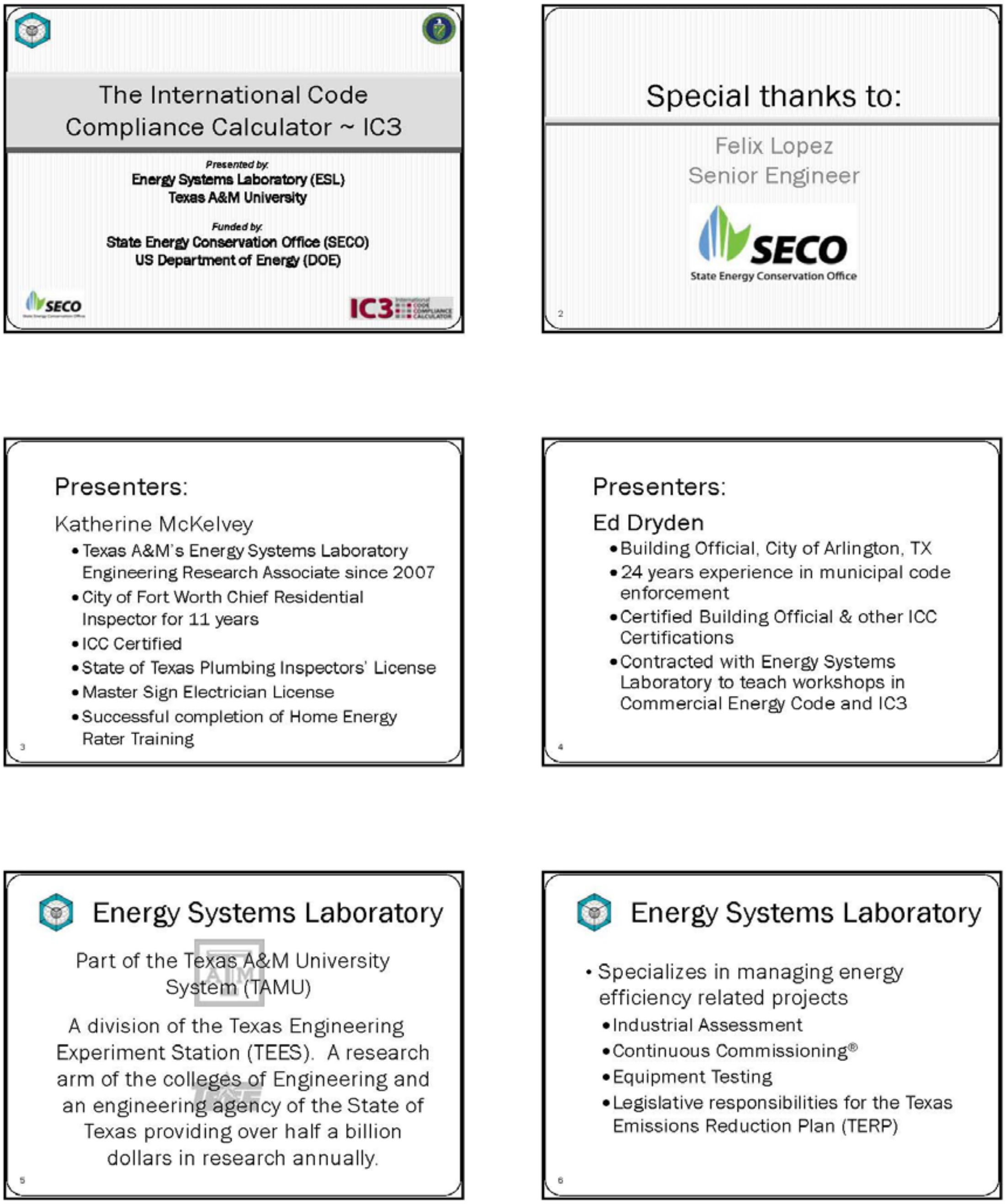


Figure 26: IC3 Calculator, part 1

Energy Systems Laboratory

Continuous Commissioning®

7

Energy Systems Laboratory

Equipment Testing Services

8

Texas Emission Reduction Plan (TERP)

- Established by 77th Texas Legislature in 2001, through enactment of Senate Bill 5
  - Assures that the air in Texas is safe to breathe
  - Develops approaches to solving environmental problems
  - Funds research and development
  - Establishes Texas Building Energy Performance Standards

9

Texas Emission Reduction Plan (TERP)

- Texas Building Energy Performance Standards
  - Assigned the Energy Systems Laboratory (ESL) to:
    - Help municipalities and counties determine the relative impacts of local amendments to the code
    - Report the status and effect of energy & emissions as impacted by local codes

10

Texas Emission Reduction Plan (TERP)

- Texas Building Energy Performance Standards
  - Assigned the Energy Systems Laboratory (ESL) to:
    - Help municipalities and counties determine the relative impacts of local amendments to the code
    - Report the status and effect of energy & emissions as impacted by local codes

11

Energy Systems Laboratory

http://esl.eslwin.tamu.edu/reports/builders-information.html

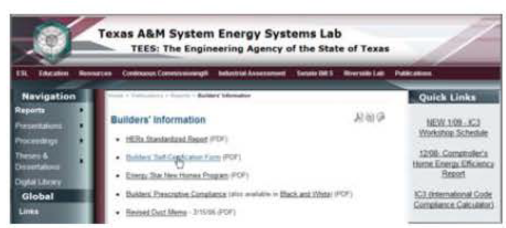


Figure 27: IC3 Calculator, part 2

Texas Emission Reduction Plan (TERP)

- Texas Building Energy Performance Standards
  - Sets the 2000 International Residential Code and the 2000 International Energy Conservation Code (IECC) with the 2001 Supplement, as the first state mandated energy codes for the State of Texas

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Texas Emission Reduction Plan (TERP)

- Texas Building Energy Performance Standards
  - •2000 International Residential Code as applicable for 1- and 2- family residential construction
  - •2000 International Energy Conservation Code with the 2001 Supplement for use in all other residential, commercial, and industrial construction.

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Texas Emission Reduction Plan (TERP)

Texas Building Energy Performance Standards

- Designed to save energy by:
  - Reducing solar heat gain
  - Improving the performance of HVAC ducts
  - Requiring openings in the thermal envelope to be sealed against air leaks
  - Setting minimum insulation levels for thermal envelope assemblies

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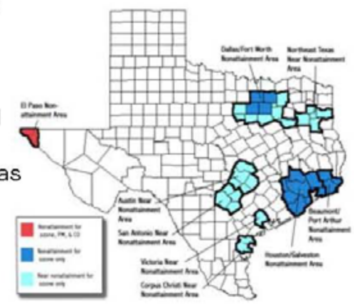
Texas Emission Reduction Plan (TERP)

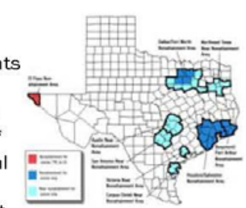
Texas' Non-attainment and Near Non-attainment Areas



16

Texas Emission Reduction Plan (TERP)

Municipalities or counties may adopt local amendments to the International Energy Conservation Code and the energy efficiency chapter of the International Residential Code, however these amendments may not result in less stringent energy efficiency requirements in nonattainment areas and affected counties.



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Energy Systems Laboratory

- Developed a series of web-based calculators allowing Texas Government and Building Industry users to design energy efficient buildings at or above code, thus documenting their emissions reductions
- International Code Compliance Calculator (IC3) was developed for residential new construction
- Many jurisdictions mandate the use of IC3

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Figure 28: ICE3 Calculator, part 3

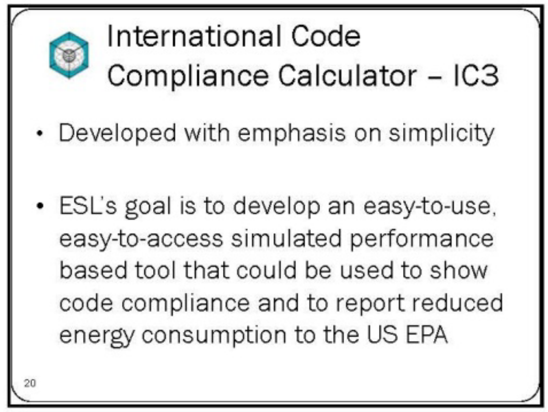
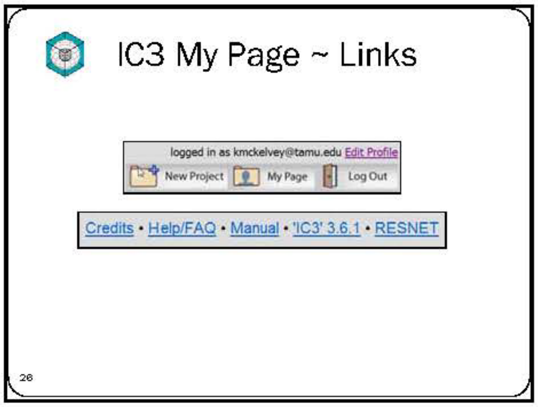
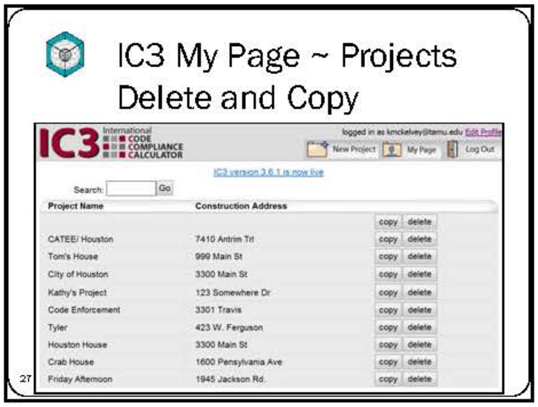
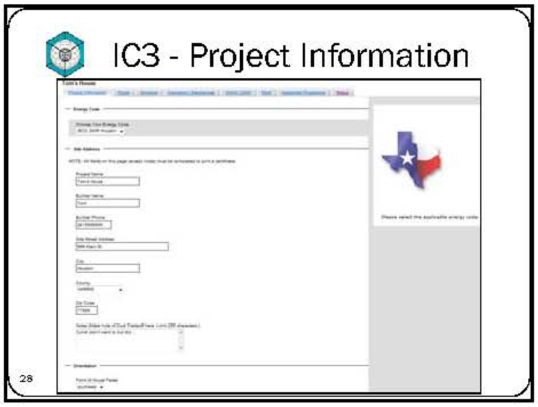
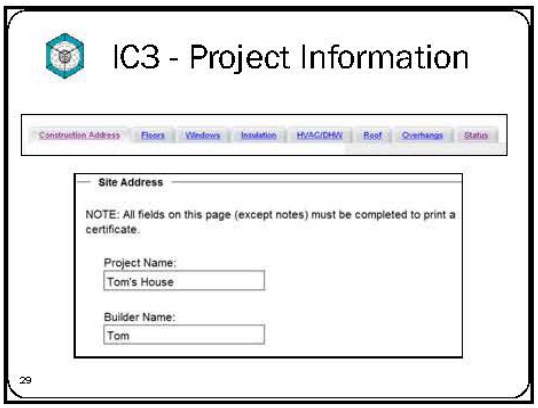


Figure 29: IC3 Calculator, part 4









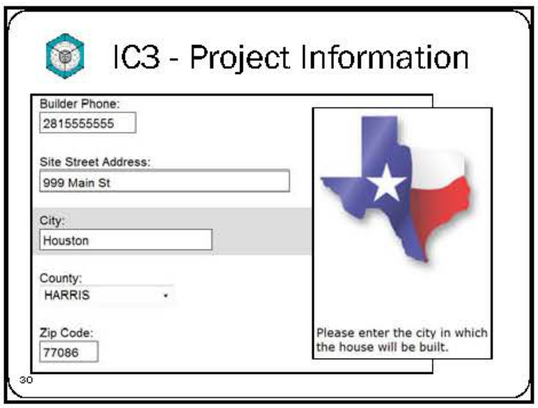
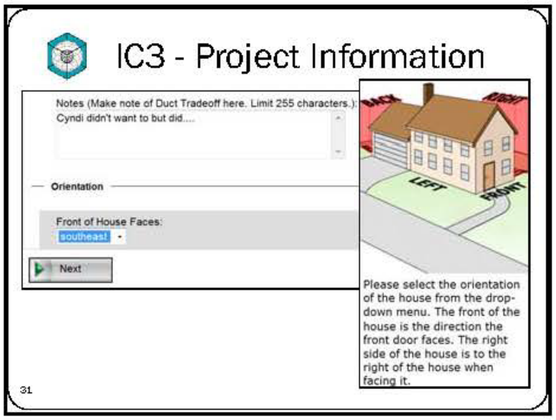
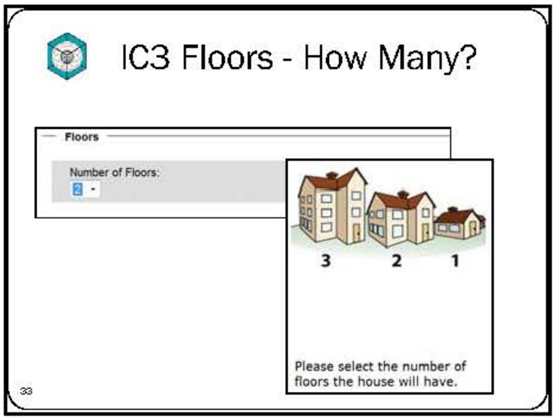
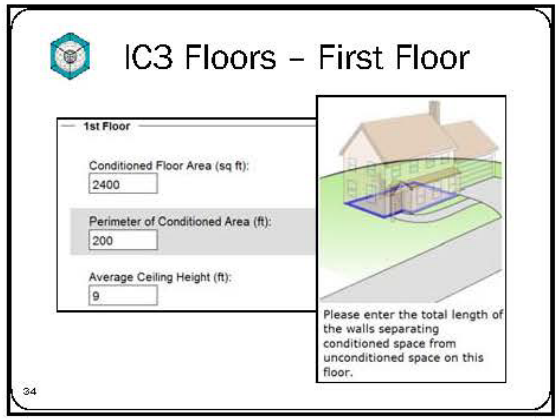
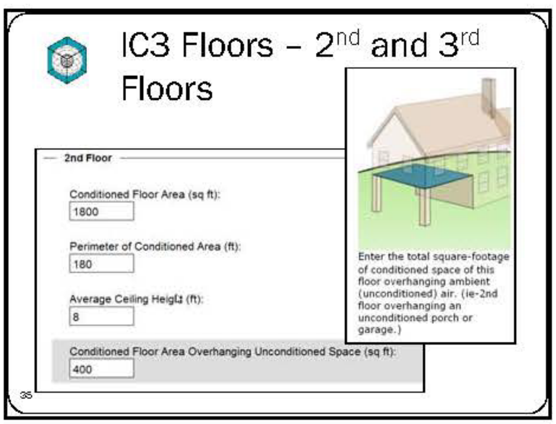


Figure 30: IC3 Calculator, part 5









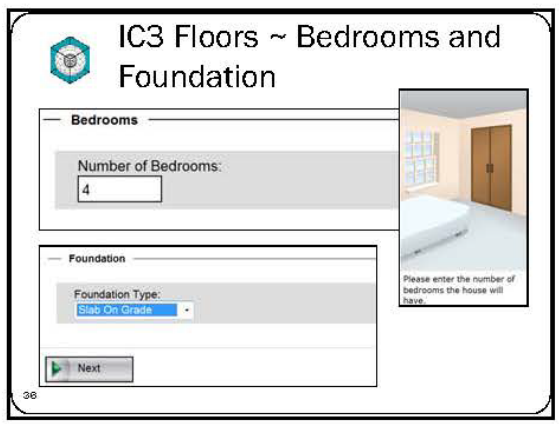
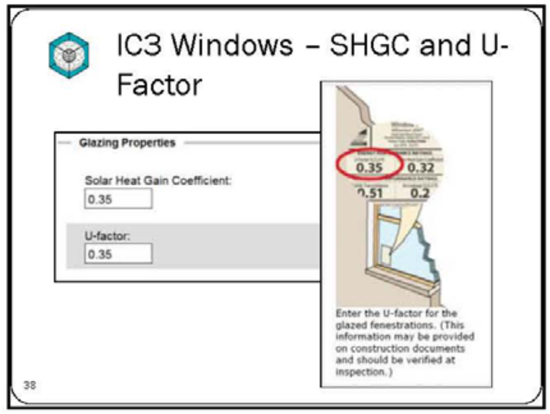
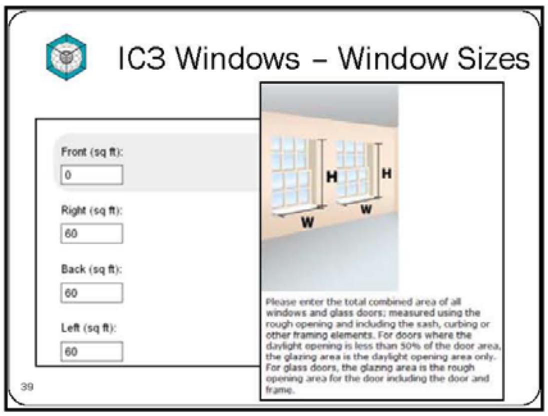
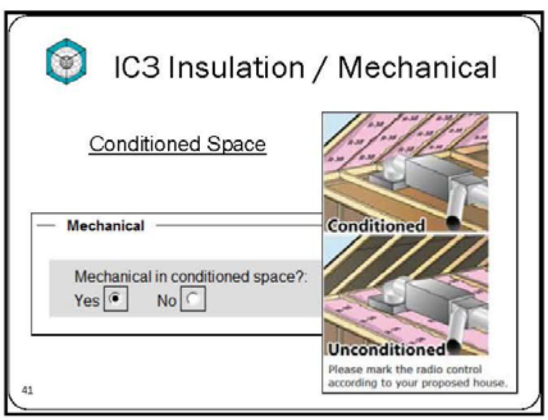


Figure 31: IC3 Calculator, part 6







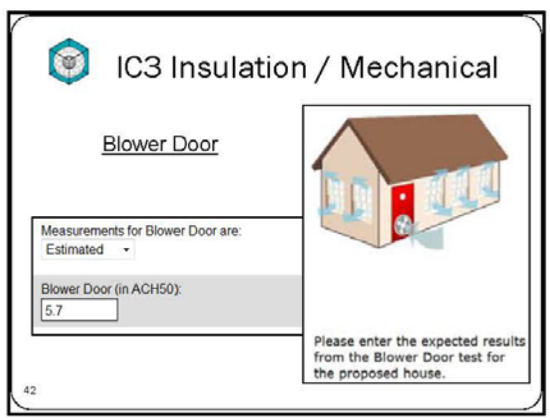
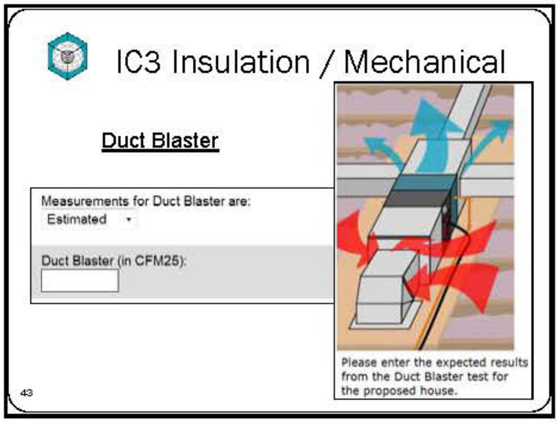
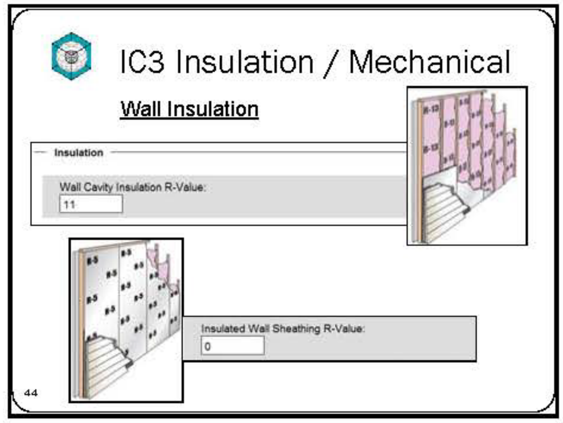
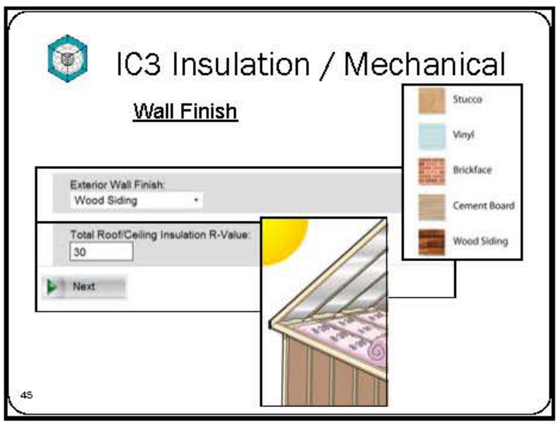
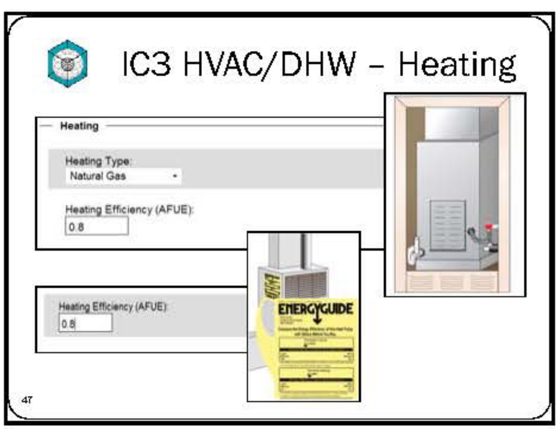


Figure 32: IC3 Calculator, part 7









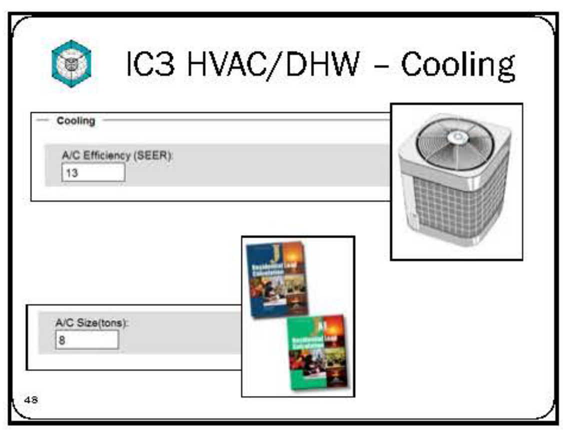
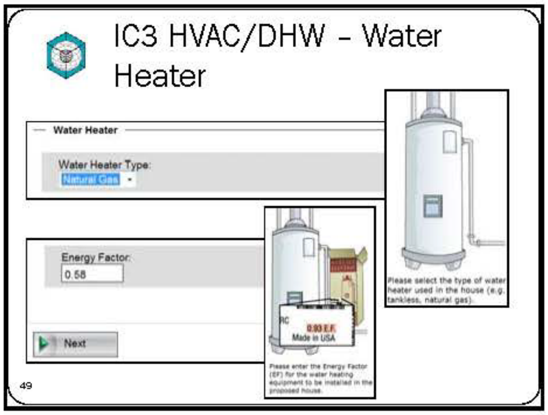
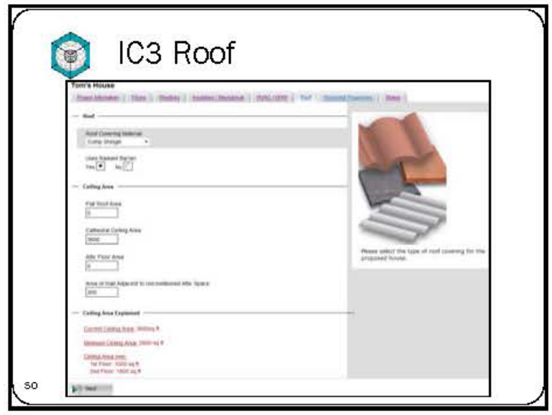
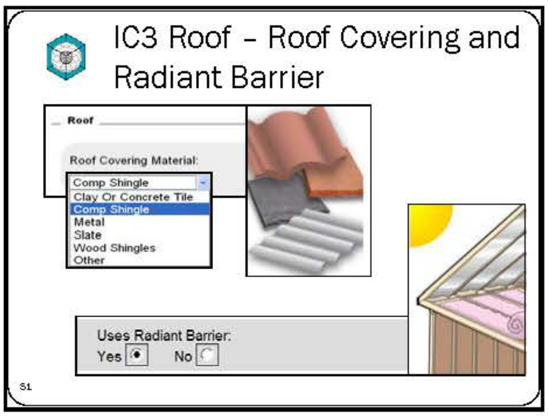
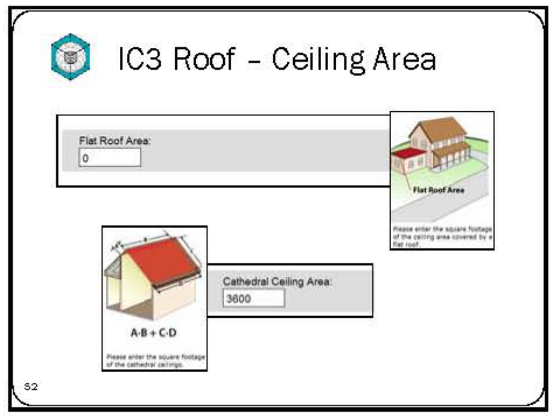


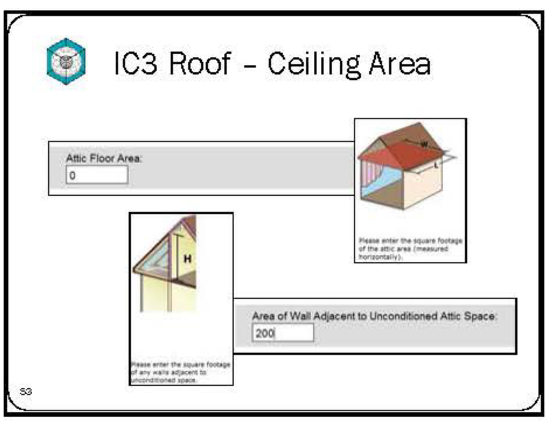
Figure 33: IC3 Calculator, part 8











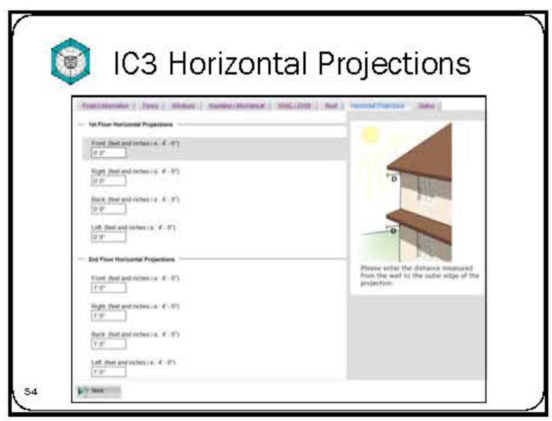
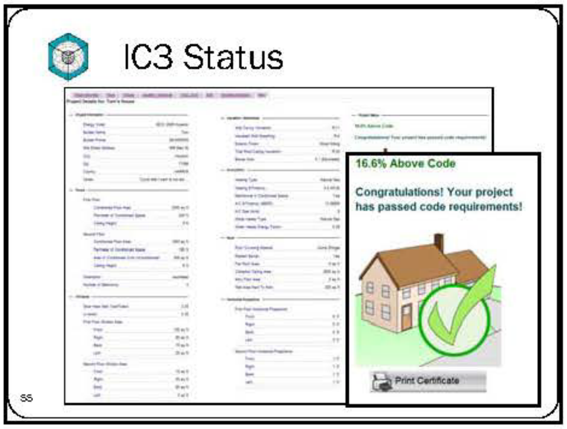
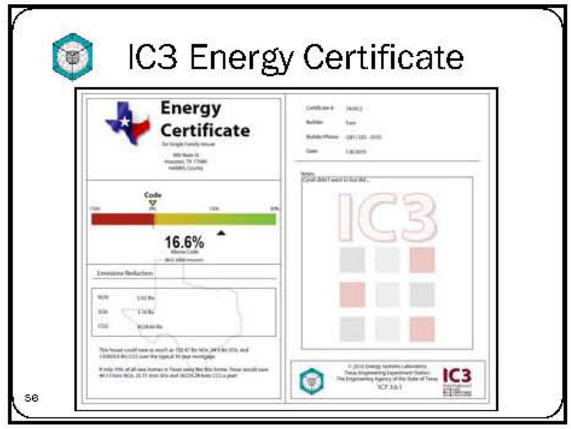
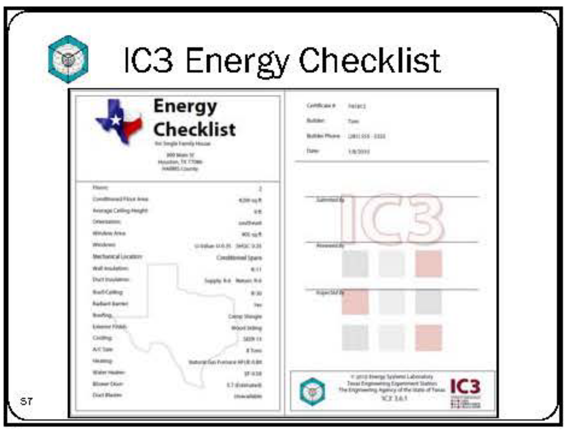
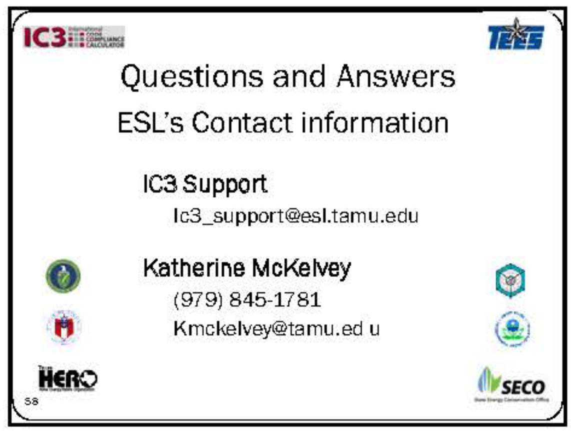


Figure 34: IC3 Calculator, part 9









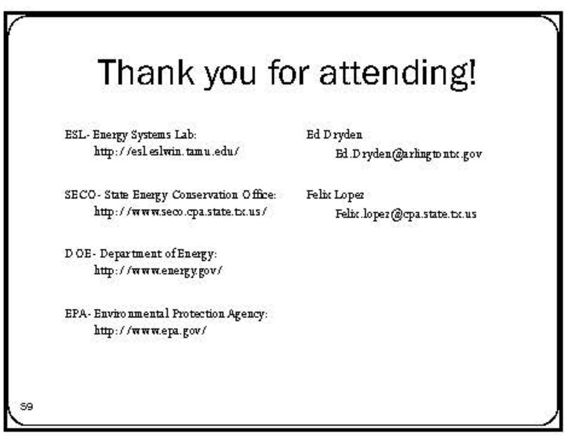
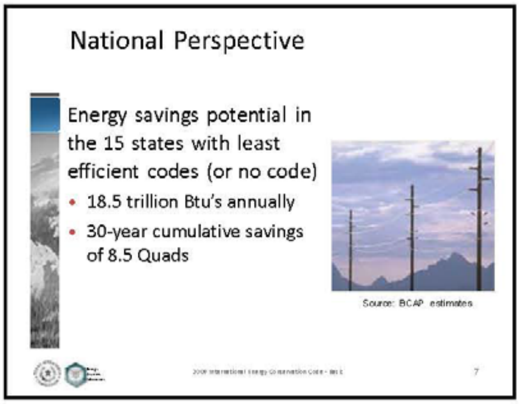
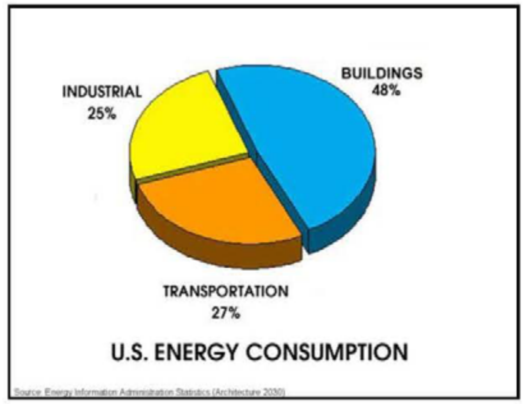
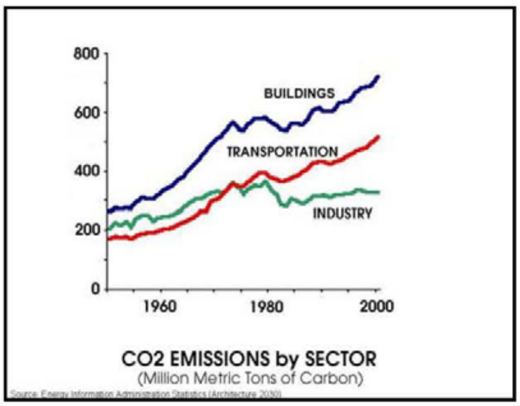


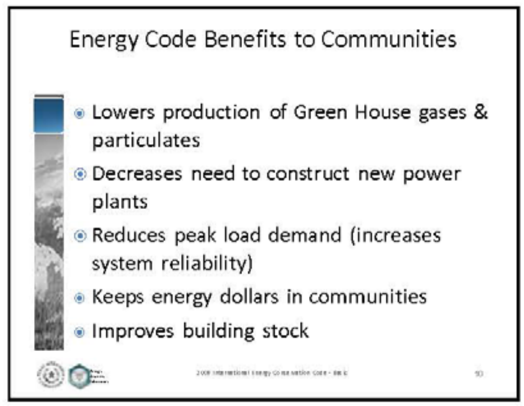
Figure 35: IC3 Calculator, part 10

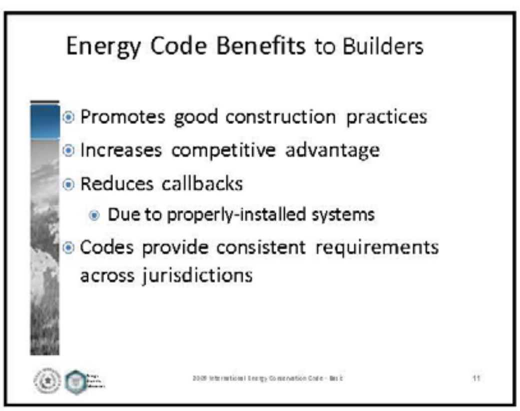
Figure 36: IECC Basic Overview part 1











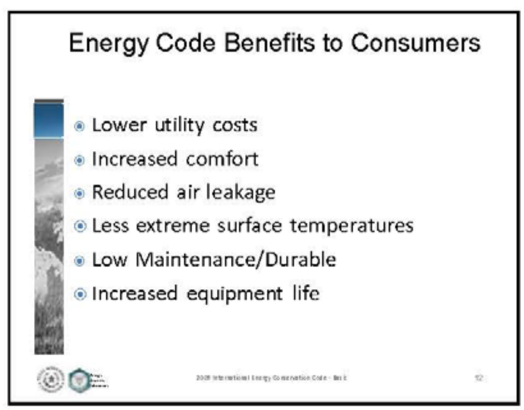
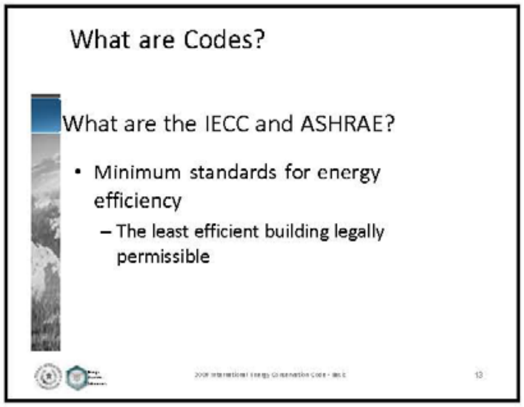
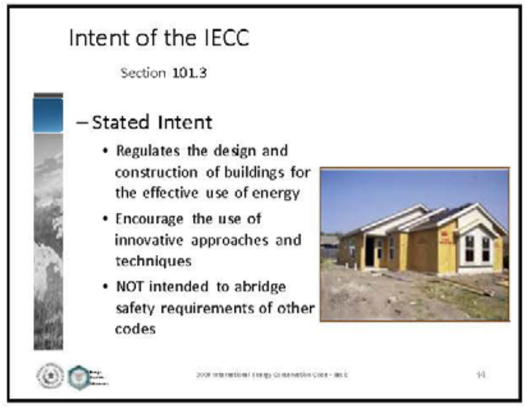
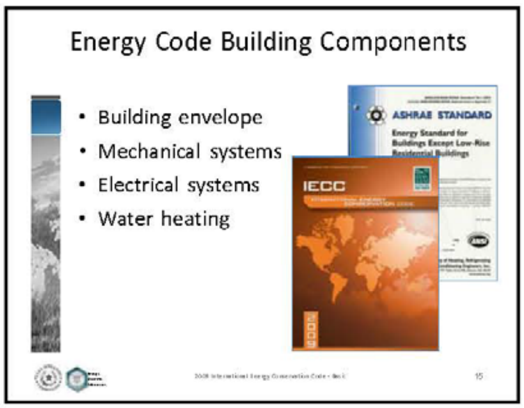
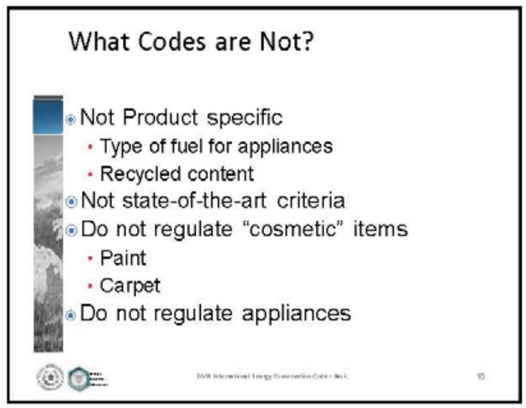


Figure 37: IECC Basic Overview part 2









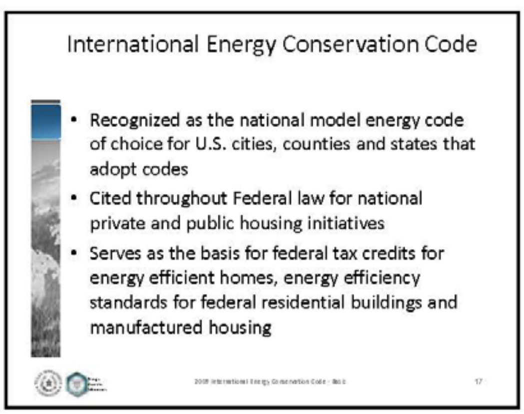
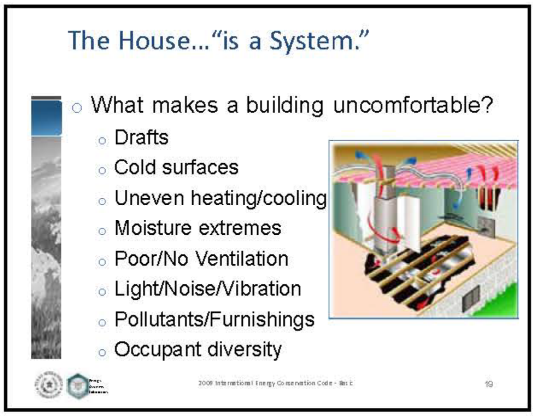
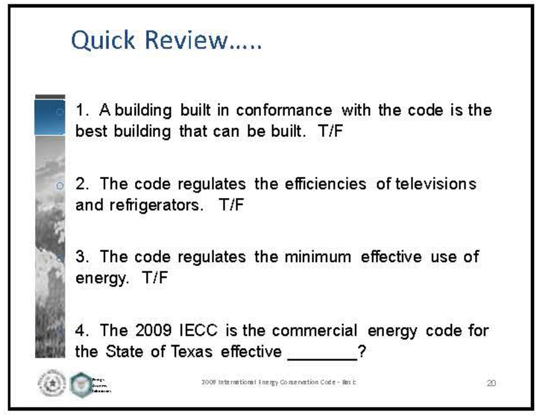
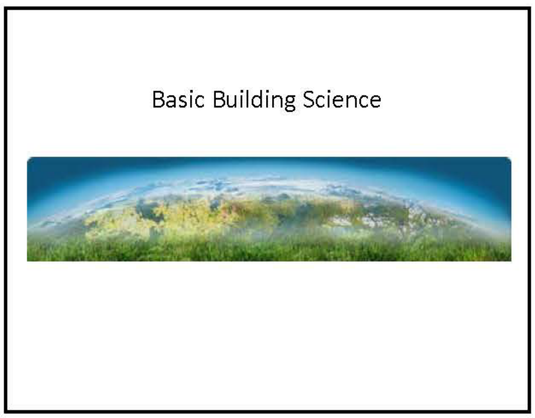
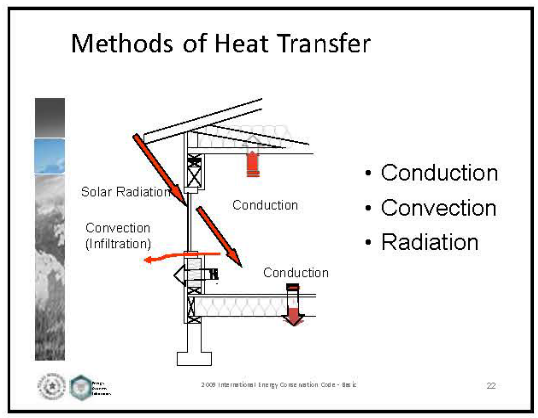


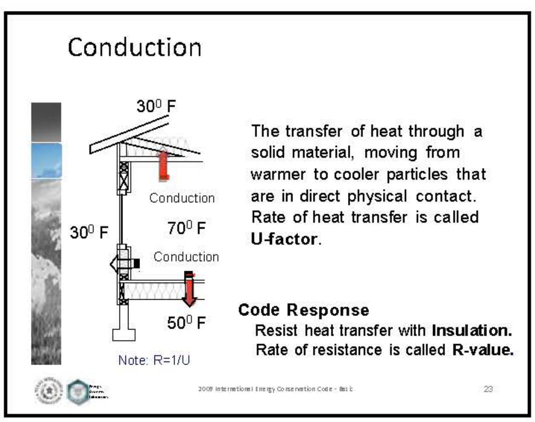
Figure 38: IECC Basic Overview part 3











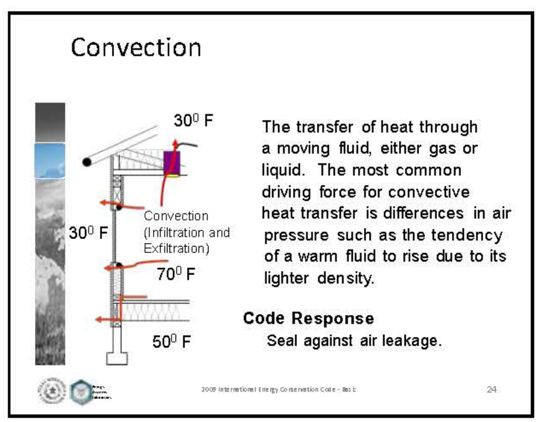
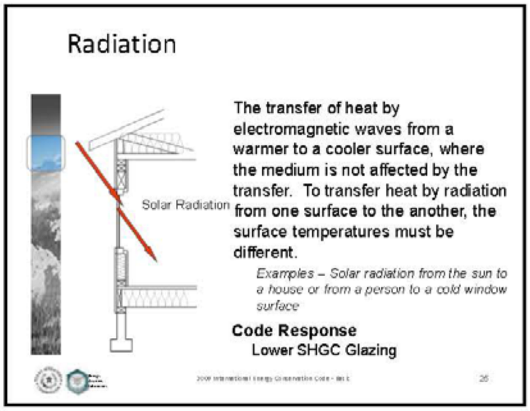
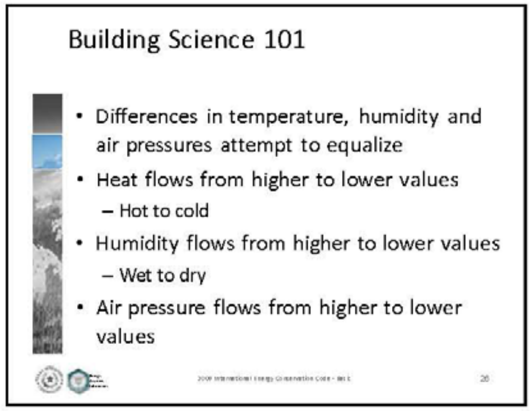
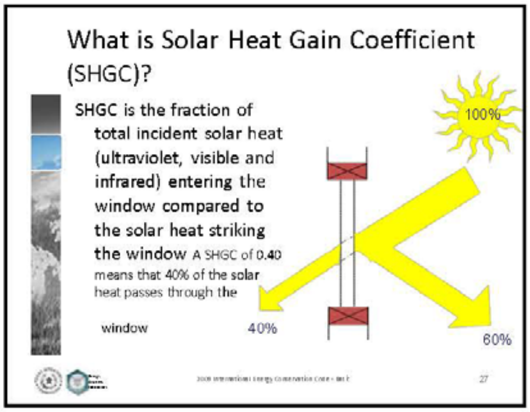


Figure 39: IECC Basic Overview part 4







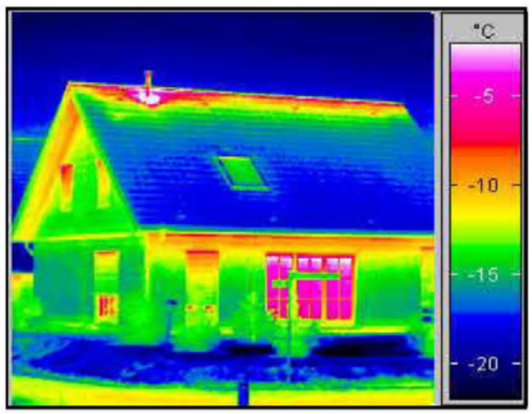
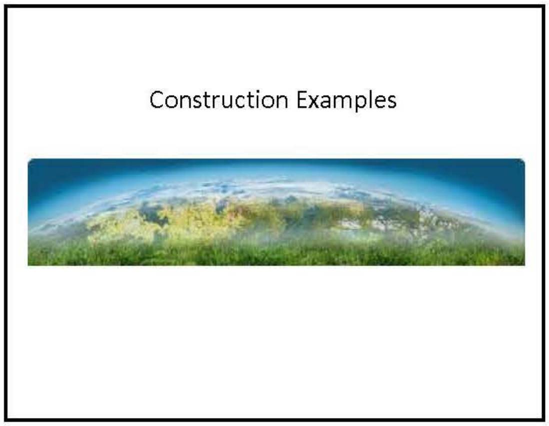


Figure 40: IECC Basic Overview part 5



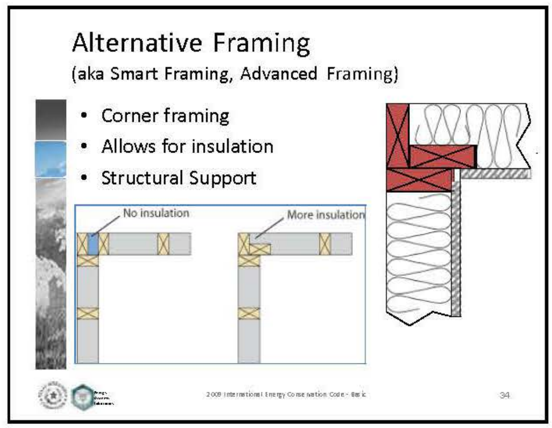
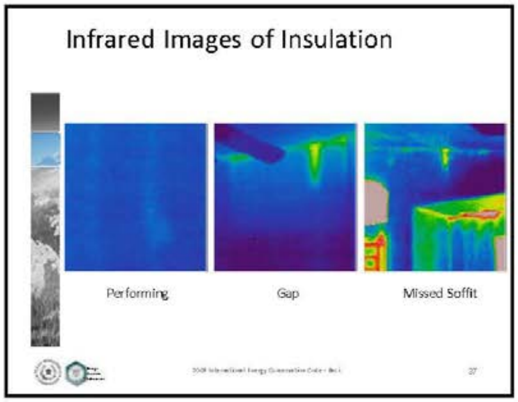
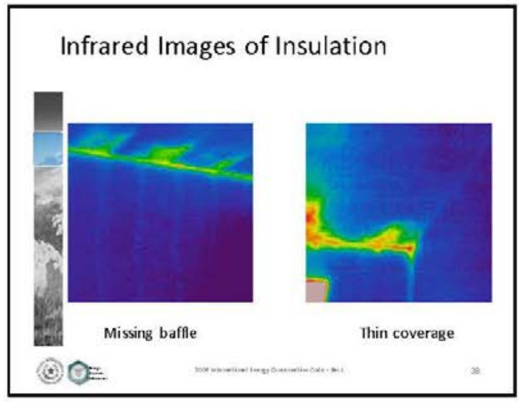
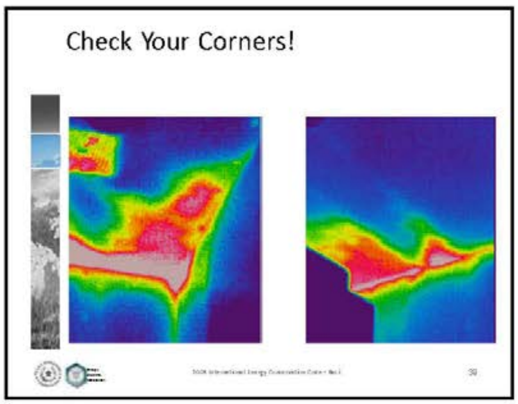


Figure 41: IECC Basic Overview part 6







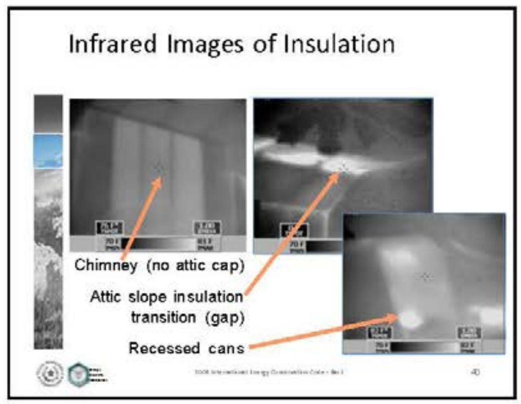
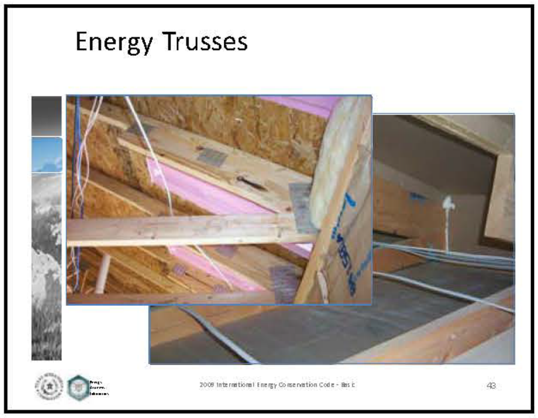
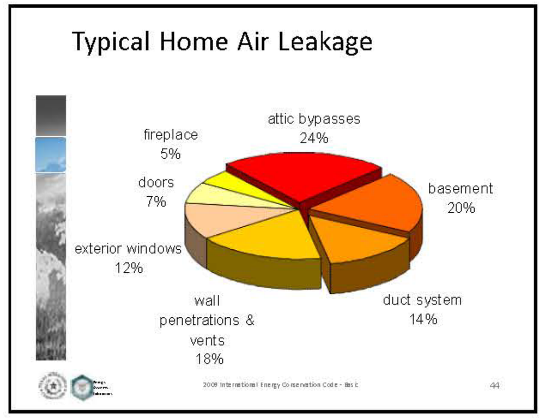
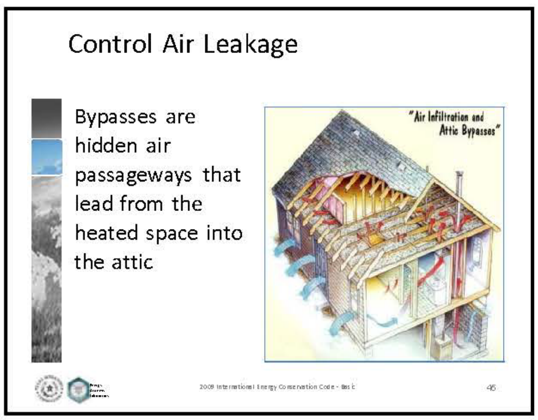


Figure 42: IECC Basic Overview part 7







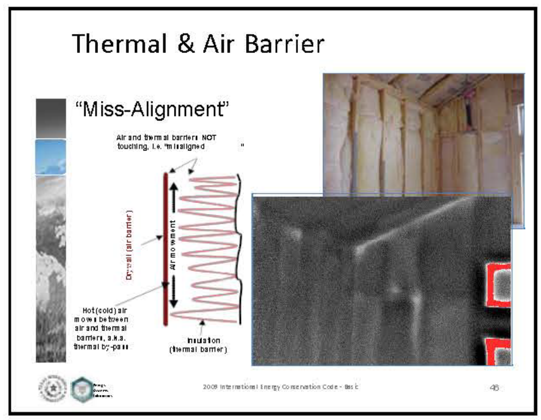
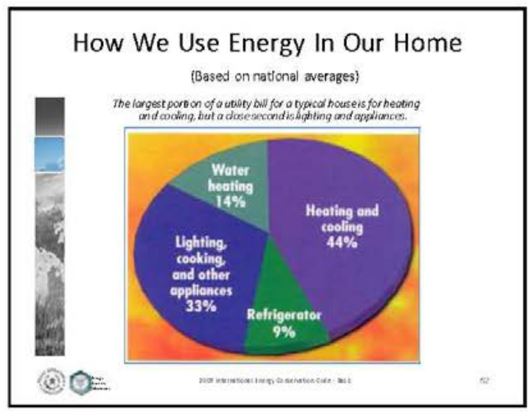
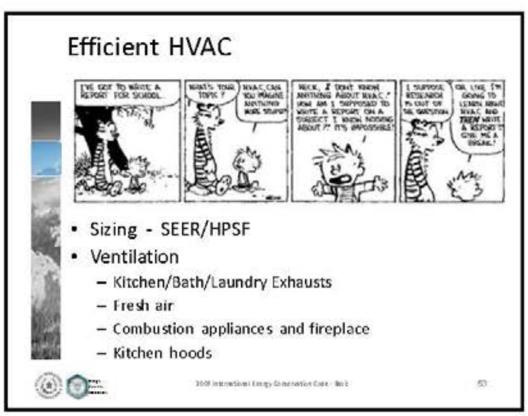


Figure 43: IECC Basic Overview part 8





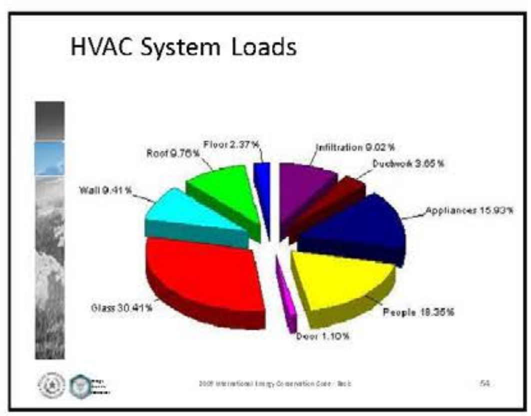
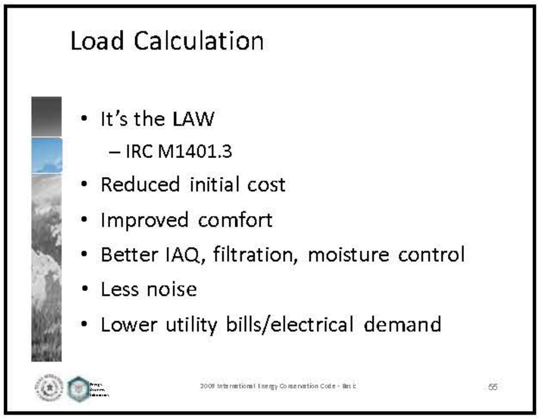
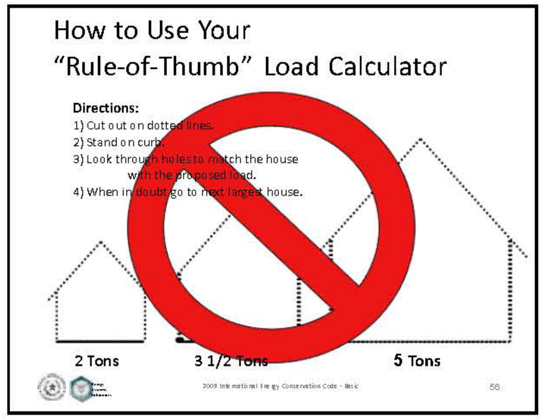
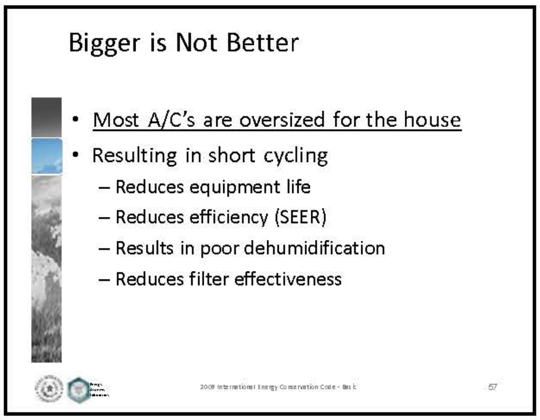
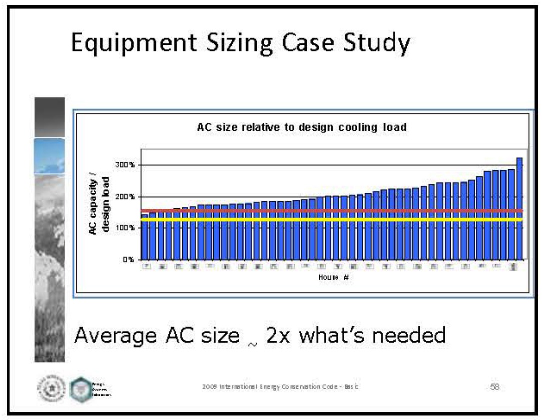


Figure 44: IECC Basic Overview part 9









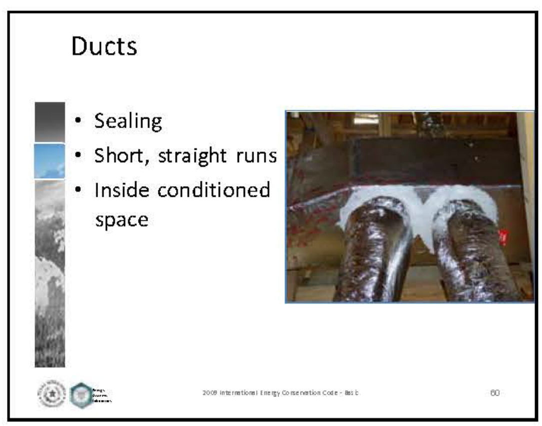
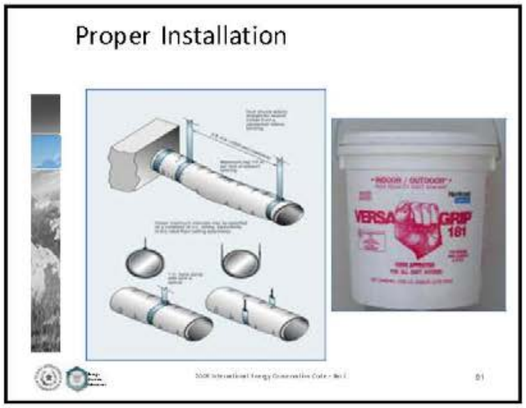
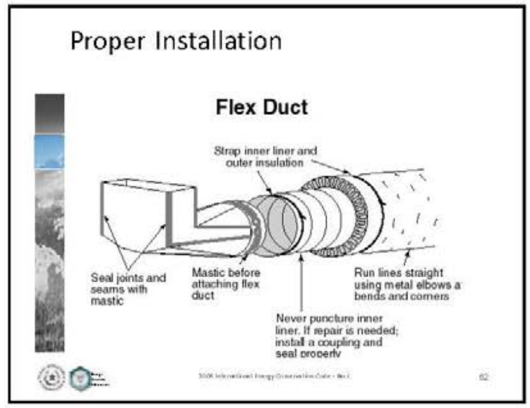


Figure 45: IECC Basic Overview part 10





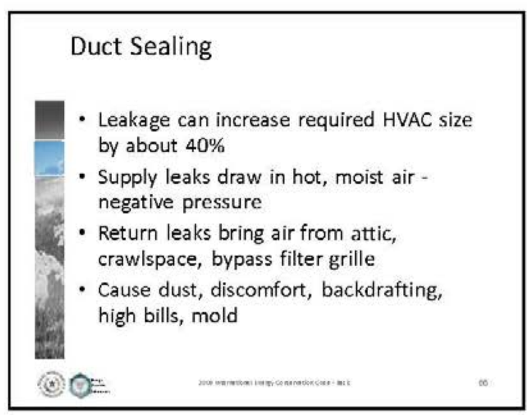
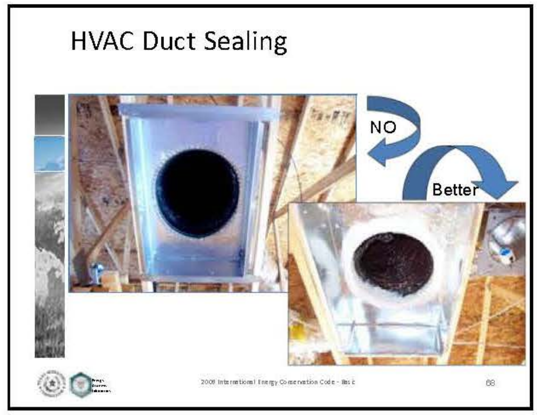


Figure 46: IECC Basic Overview part 11



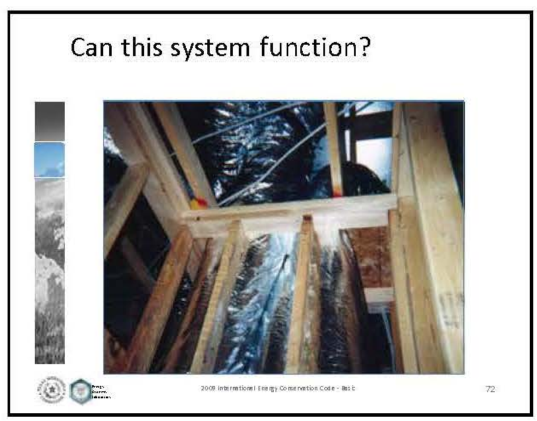
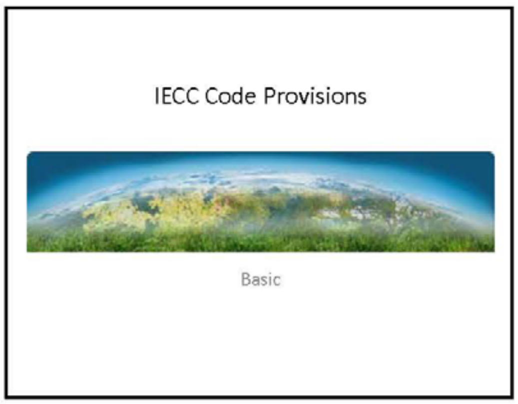
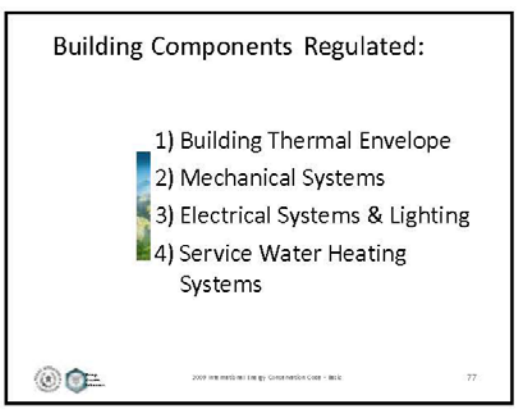


Figure 47: IECC Basic Overview part 12





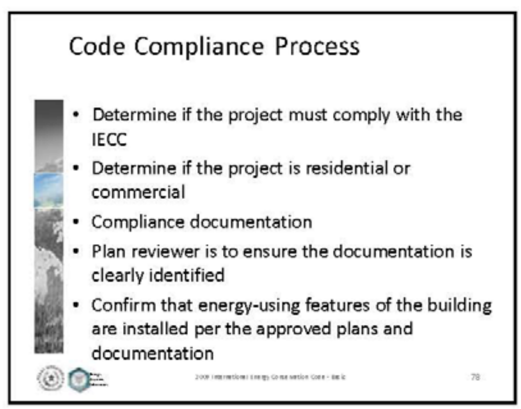
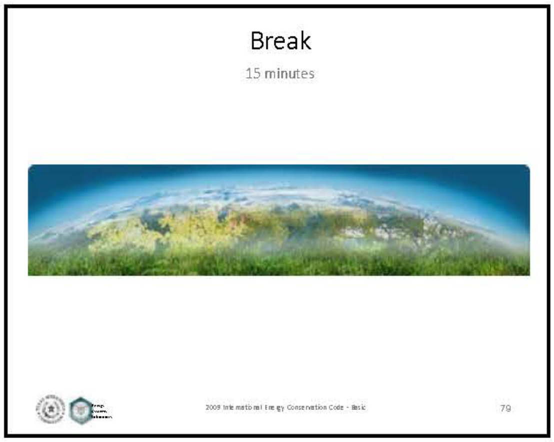
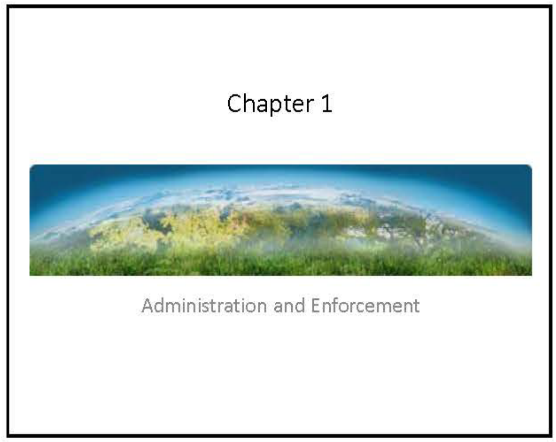
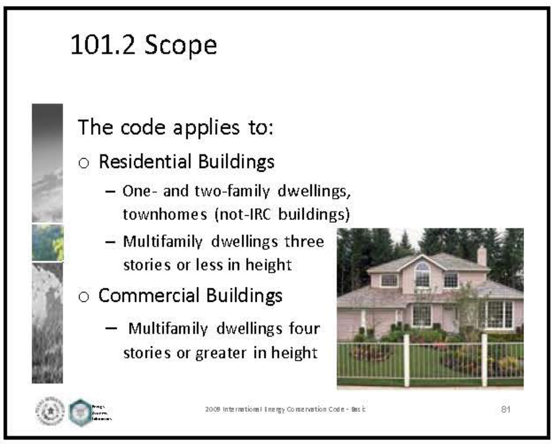
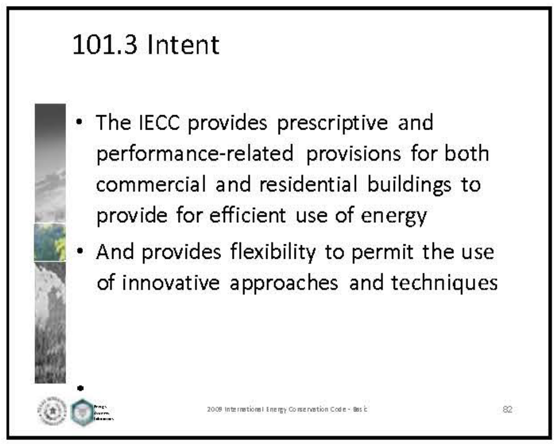


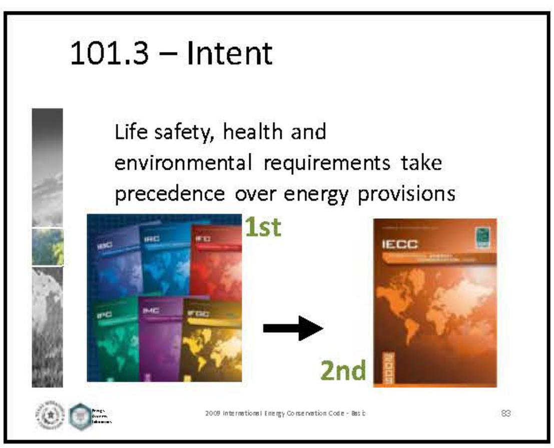
Figure 48: IECC Basic Overview part 13











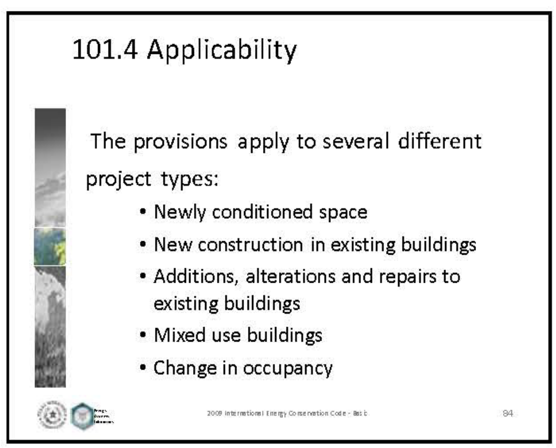
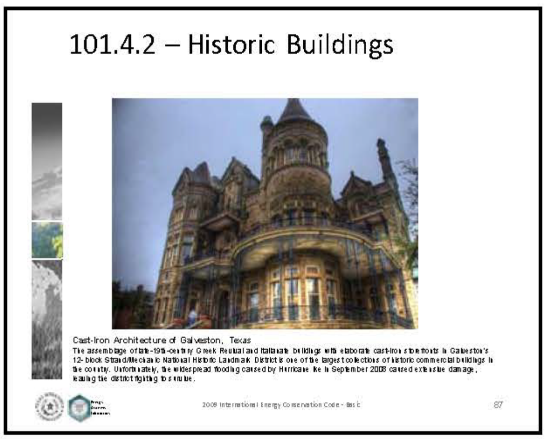
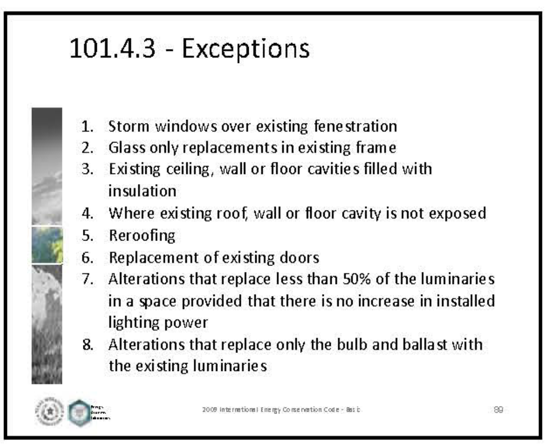


Figure 49: IECC Basic Overview part 14





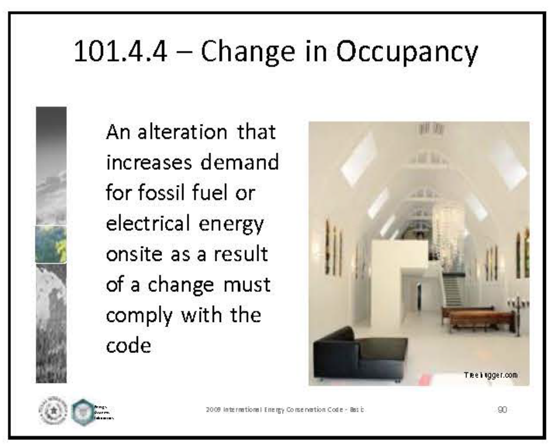
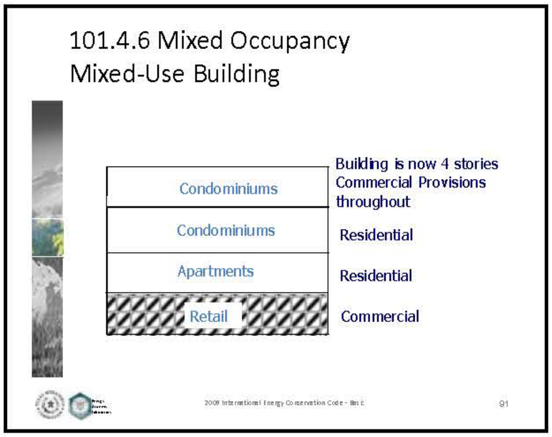
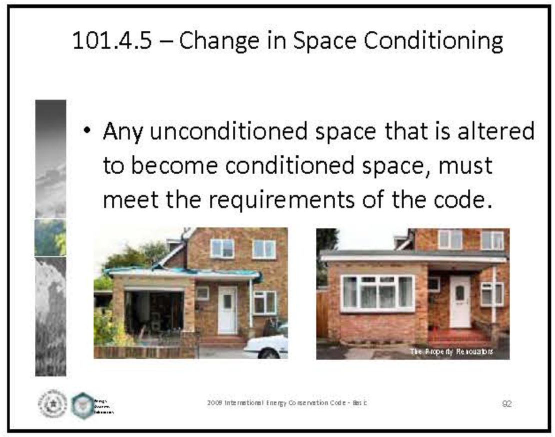
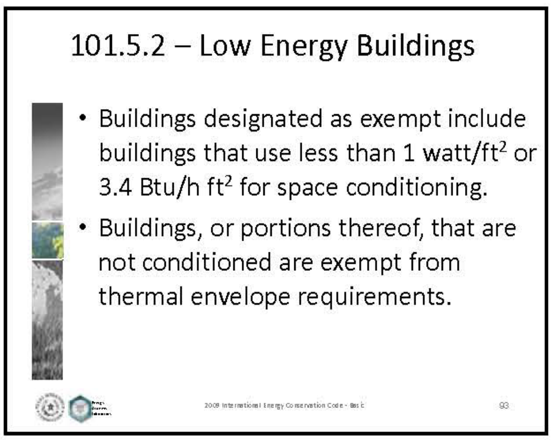
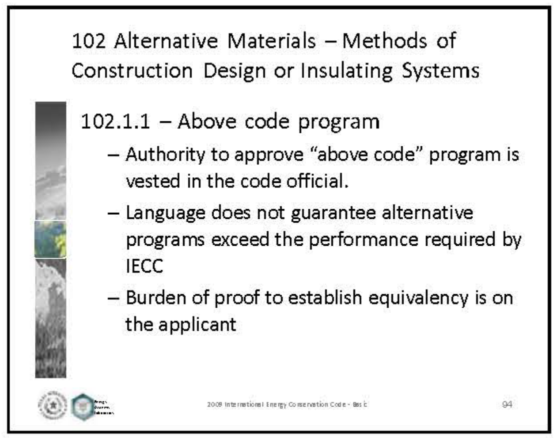


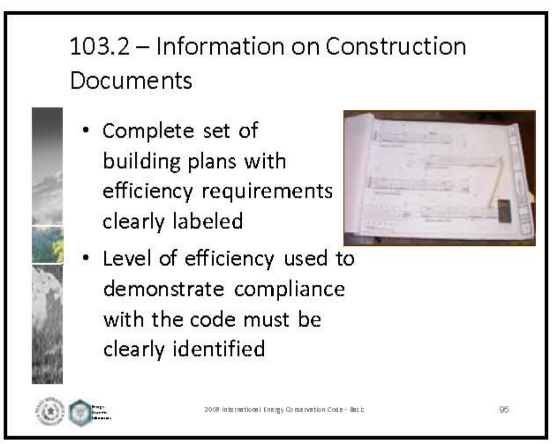
Figure 50: IECC Basic Overview part 15











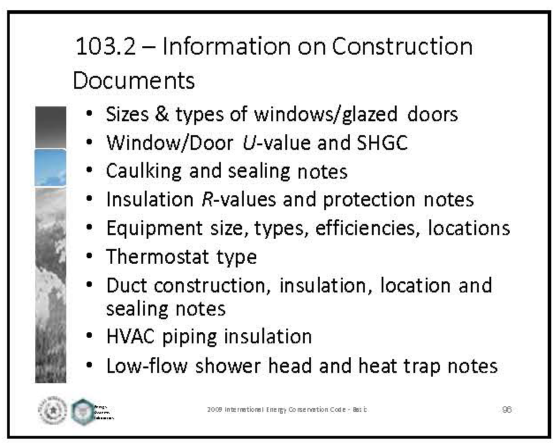
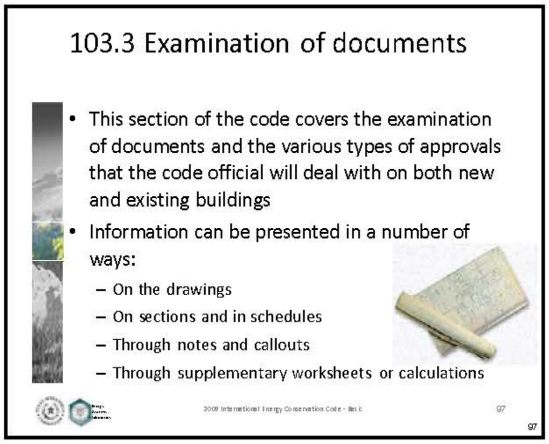
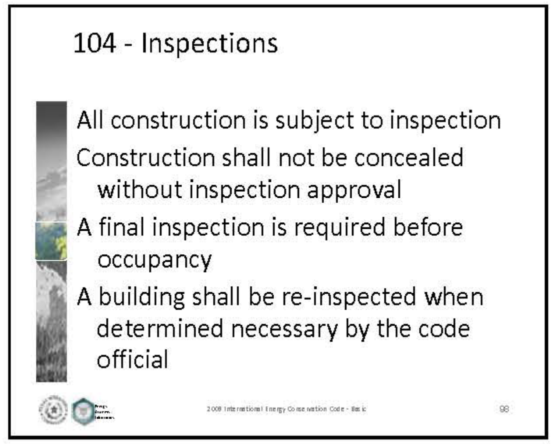
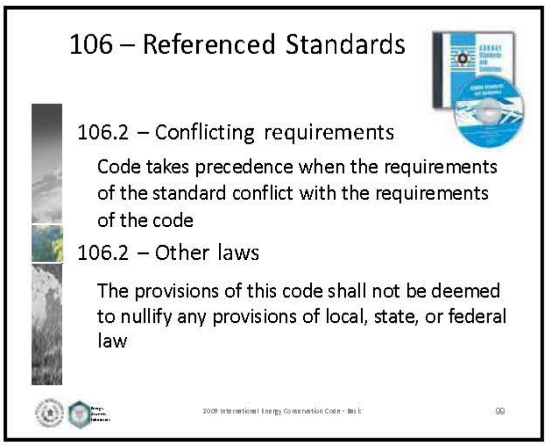
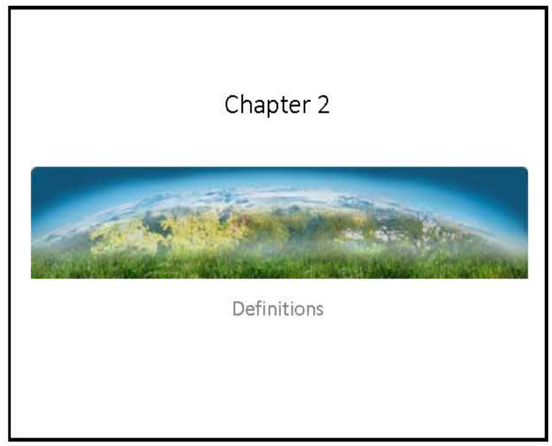


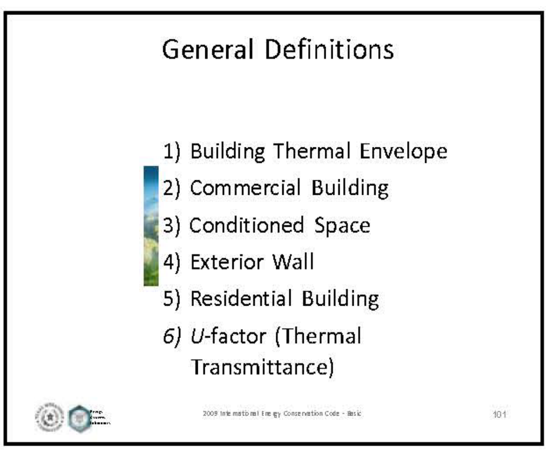
Figure 51: IECC Basic Overview part 16











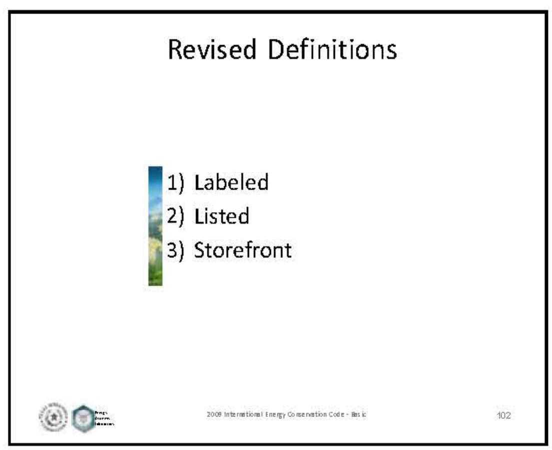


Figure 52: IECC Basic Overview part 17

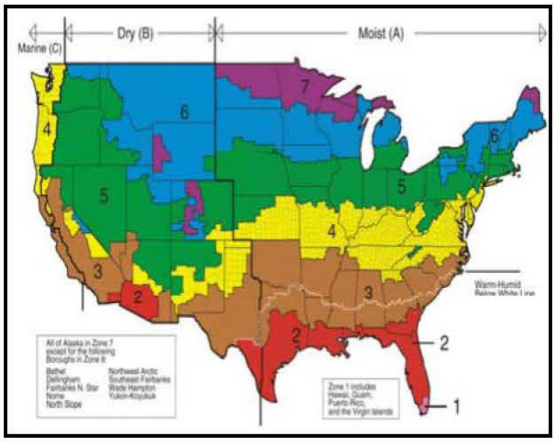
New Definitions

1) Air barrier
2) C-factor (thermal conductance)
3) Daylight zone
4) Demand control ventilation
5) Entrance door
6) Fan systems
   - Fan Brake Horsepower
   - Fan System BHP
   - Fan System Design Conditions
   - Fan System Motor Nameplate HP
7) F-factor
8) High-efficacy lamps
9) Nameplate horsepower

2009 International Energy Conservation Code - Basic 103

Chapter 3

Design Conditions



Section 303 –Materials, Systems and Equipment

- 303.1 – Insulation materials to be labeled on site with the rated R-value

2009 International Energy Conservation Code - Basic 106

Insulation Product Rating

- Section 303.1.4 – Requires that R-value of insulation be determined in accordance with US FTC *R*-value rule (CFR Title 16, Part 460, May 31, 2005)
  - *New* provision in the 2009 IECC

2009 International Energy Conservation Code - Basic 107

Fenestration Product Rating

- 303.1.3 – Fenestration product rating
  - U-factors of glazed windows, doors & skylights to be determined per NFRC 100
  - SHGC of glazed windows, doors & skylights to be determined per NFRC 200
  - Fenestration products not labeled accordingly are assigned "Default" values

2009 International Energy Conservation Code - Basic 108

Figure 53: IECC Basic Overview part 18

NFRC Window Label Example

2009 International Energy Conservation Code - Basic 109

Fenestration Default Values

- 303.1.3 – Fenestration product rating
  - Table 303.1.3(1)
    - Default Glazed Fenestration U-Factor
  - Table 303.1.3(2)
    - Default Door U-Factors
  - Table 303.1.3(3)
    - Default Glazed Fenestration SHGC

2009 International Energy Conservation Code - Basic 110

Default Glazed Fenestration U-Factor

TABLE 303.1.3(1)
DEFAULT GLAZED FENESTRATION *U*-FACTOR

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT Single	SKYLIGHT Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

2009 International Energy Conservation Code - Basic 111

Default Door U-Factors

TABLE 303.1.3(2)
DEFAULT DOOR *U*-FACTORS

DOOR TYPE	*U*-FACTOR
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

2009 International Energy Conservation Code - Basic 112

Solar Heat Gain Coefficient

TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC

SINGLE GLAZED Clear	SINGLE GLAZED Tinted	DOUBLE GLAZED Clear	DOUBLE GLAZED Tinted	GLAZED BLOCK
0.8	0.7	0.7	0.6	0.6

2009 International Energy Conservation Code - Basic 113

Compliance Approaches

Chapter 4 – Residential
Chapter 5 - Commercial

Figure 54: IECC Basic Overview part 19

Chapter 4 – Residential Energy Efficiency

- 401.2 – Compliance
  - Must comply with prescriptive provisions, either:
    - 402.1 thru 402.3 (Insulation & Fenestration),
    - 403.2.1 (Duct Insulation) , and
    - 404 (Lighting)
  - Or:
    - 405 - Performance
  - AND…….

2009 International Energy Conservation Code - Basic 115

Chapter 4 – Residential Energy Efficiency (cont'd)

- 8 Mandatory Provisions:
  - 401 – Compliance statement
  - 402.4 – Air leakage Requirements
  - 402.5 – Max fenestration *U*-factor & SHGC (Area weighted averages)
  - 403.1 – Mechanical Systems Controls
  - 403.2.2 –HVAC Duct Sealing
  - 402.2.3 – Building Cavities not used as supply ducts
  - 403.3 thru 402.9 – Piping insulation, ventilation, complex systems, snow melt, and swimming pools

2009 International Energy Conservation Code - Basic 116

Residential Compliance Process

Prescriptive
Component values
Table 402.1.1

U-Factor and "UA" Alternatives
U-factor
402.1.3
or
Total Building UA
402.1.4

Simulated Performance (software)
Simulated Performance Alternative
405

2009 International Energy Conservation Code - Basic 117

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.55	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
5	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

2009 International Energy Conservation Code - Basic 118

Chapter 5 – Commercial Energy Efficiency

- 501.1 – Scope
  - Commercial buildings or portions of commercial buildings shall meet either:
    - AHSRAE/IESNA Standard 90.1
  - Or:
    - This Chapter

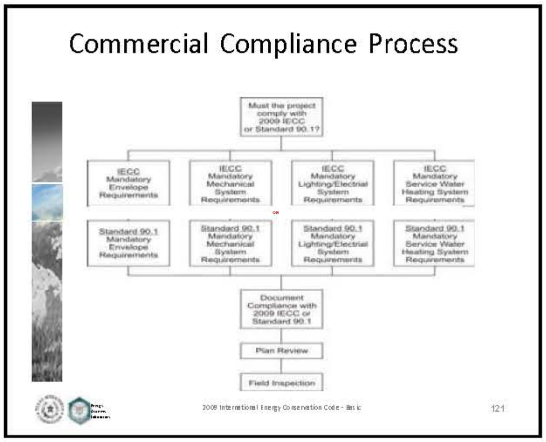
2009 International Energy Conservation Code - Basic 119

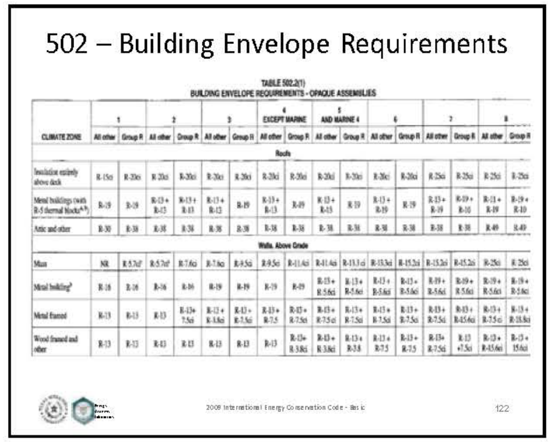
Chapter 5 – Commercial Energy Efficiency

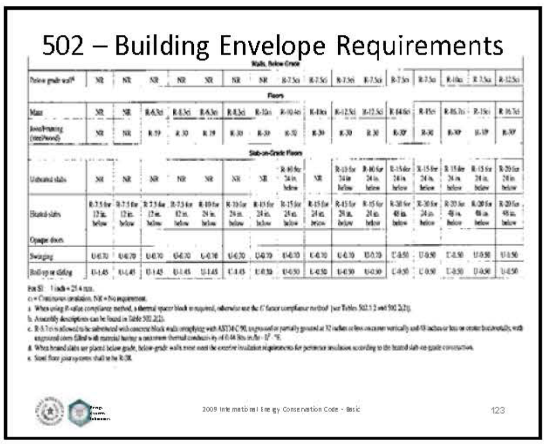
- 501.2 – Application – Shall comply with:
  - 502 – Building Envelope
  - 503 – Building Mechanical Systems
  - 504 – Service Water Heating
  - 505 – Electrical Power and Lighting Systems
- Or – similar provisions in ASHRAE 90.1
- Each component must be satisfied independently

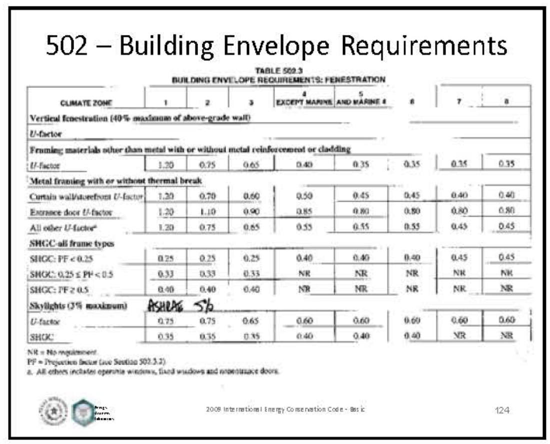
2009 International Energy Conservation Code - Basic 120

Figure 55: IECC Basic Overview part 20









CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
U-factor								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC-all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum) ASHRAE 5%								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

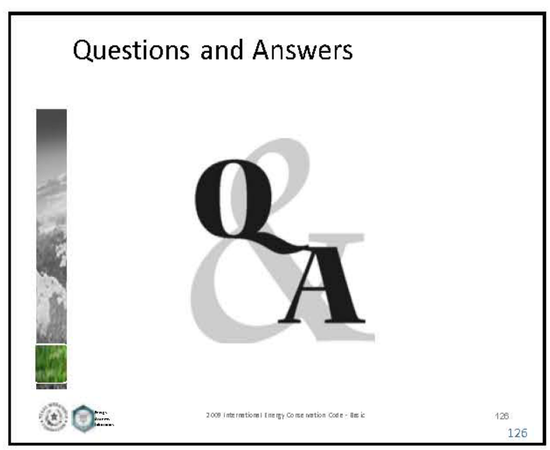


Figure 56: IECC Basic Overview part 21

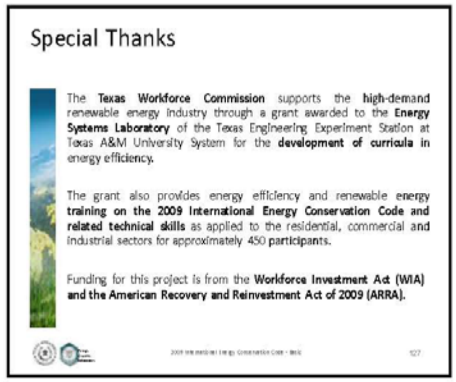
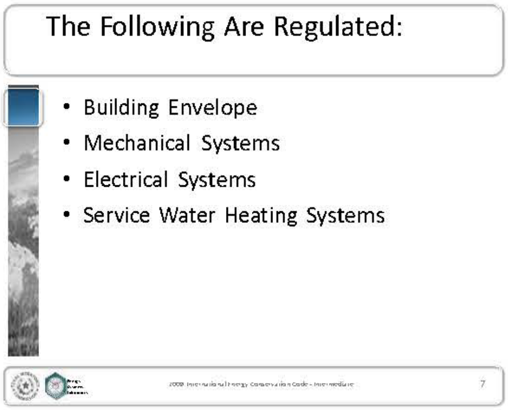
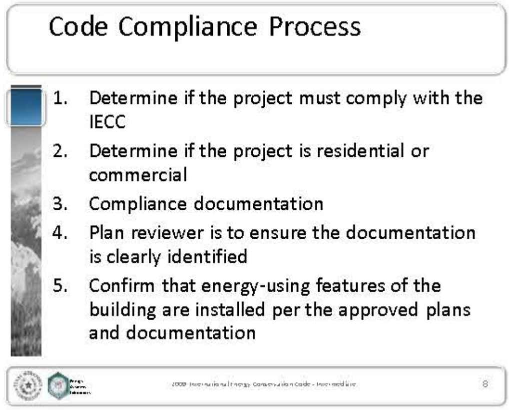
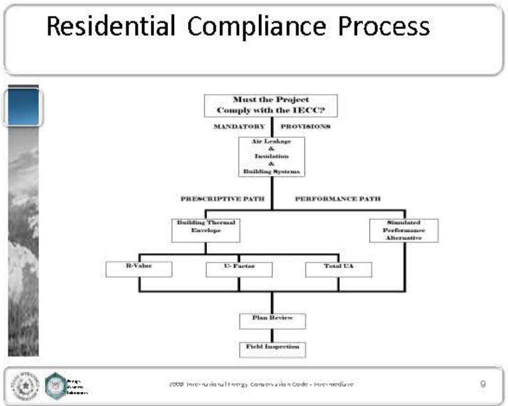


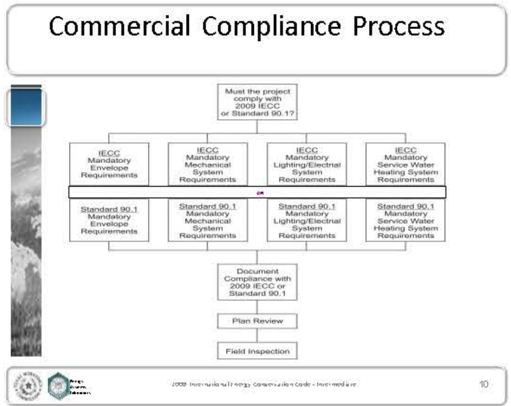
Figure 57: IECC Basic Overview part 22

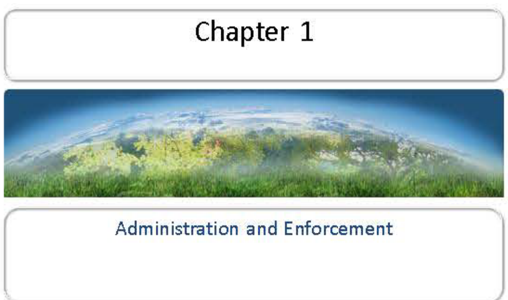
Figure 58: IECC Intermediate Overview part 1











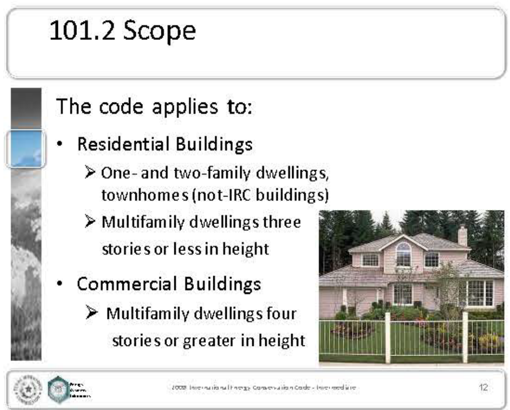
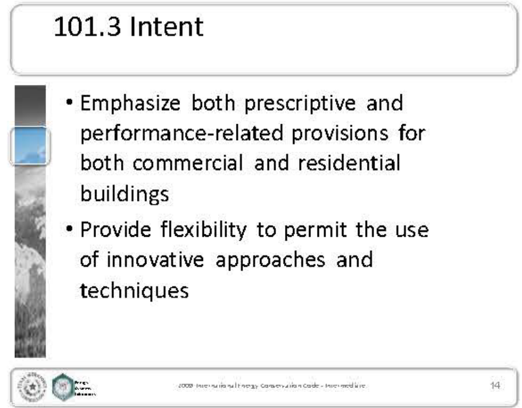
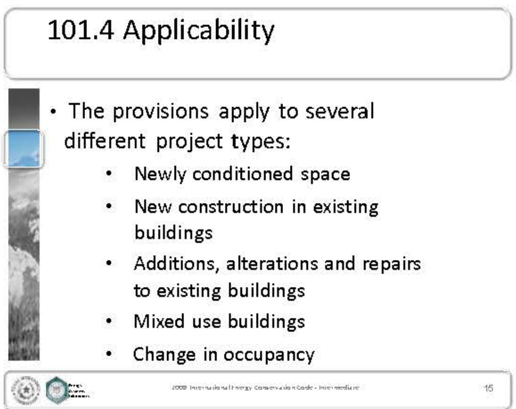
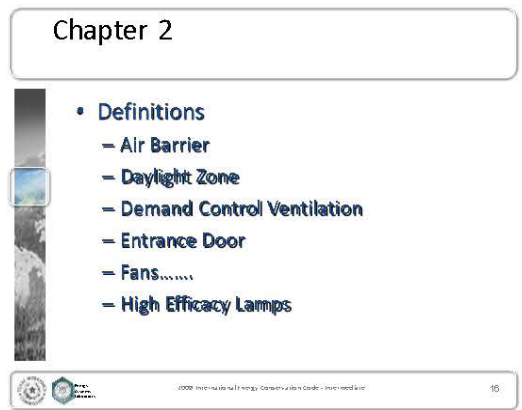
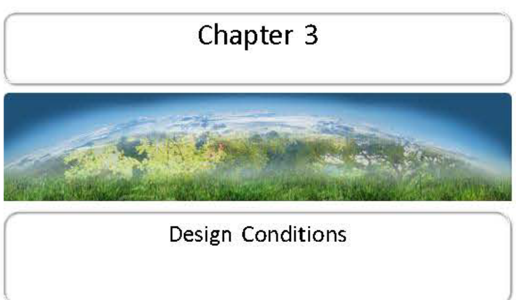


Figure 59: IECC Intermediate Overview part 2









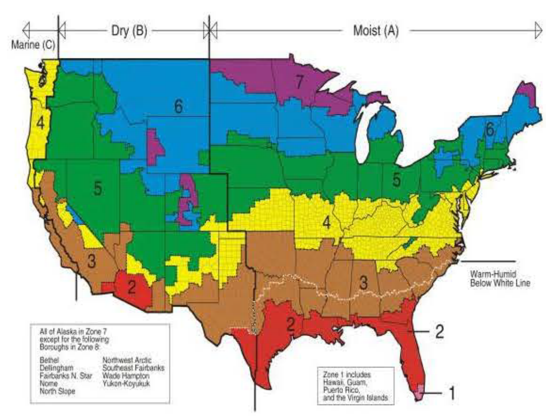
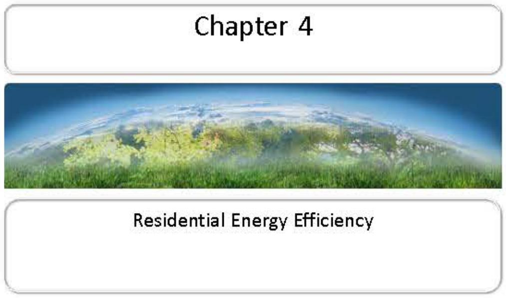
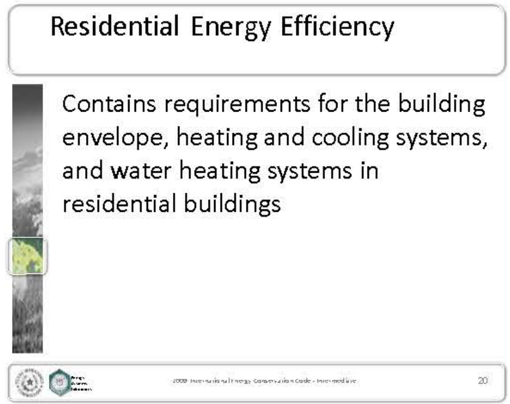
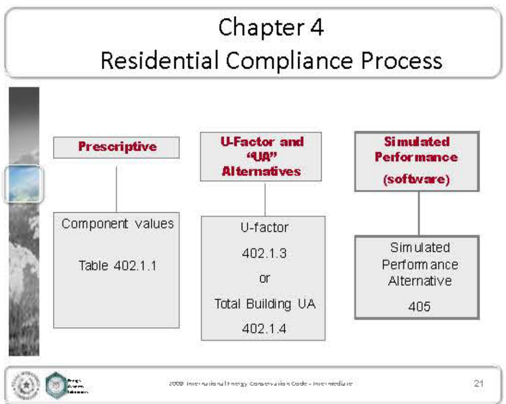


Figure 60: IECC Intermediate Overview part 3







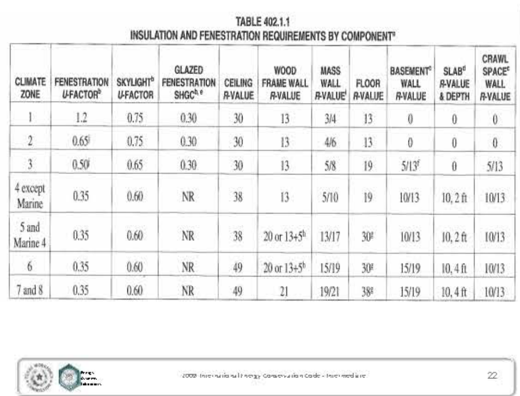


TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

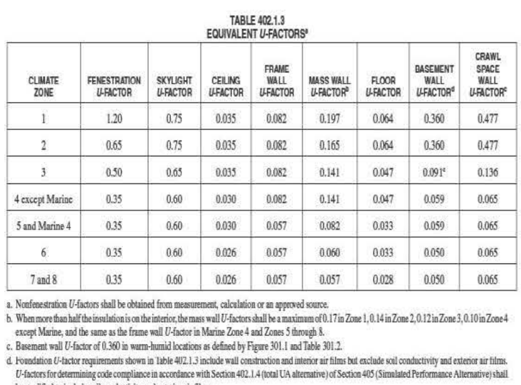


TABLE 402.1.3
EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.050	0.065

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, and the same as the frame wall U-factor in Marine Zone 4 and Zones 5 through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.
d. Foundation U-factor requirements shown in Table 402.1.3 include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section 402.1.4 (total UA alternative) of Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air films.

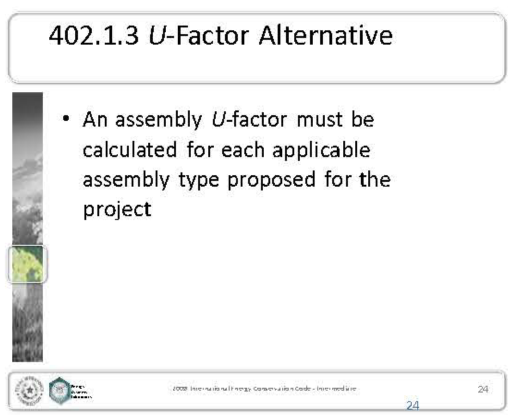


Figure 61: IECC Intermediate Overview part 4

Calculating Assembly *U*-Factors

- An area-weighted average *U*-factor is calculated for the wall system that takes into account the effects of framing
  - An *R*-value must be determined for each different material in the assembly
  - The *R*-values are then totaled to determine the total *R*-value through each thermal path of the assembly
  - The total *R*-values are then converted to *U*-factors by taking the reciprocal of the *R*-value

Sample Calculation - Walls

$$U_{ow} = \frac{(U_{w1} \times A_{w1}) + (U_{w2} \times A_{w2}) + \ldots}{A_{w1} + A_{w2} + \ldots}$$

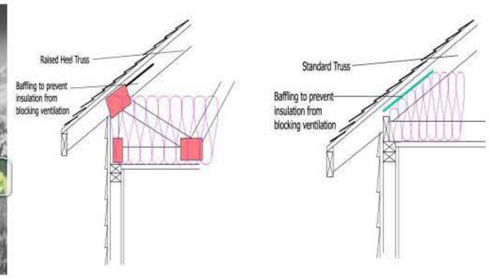
Where

- U_{w1} = *U*-factor of opaque wall number 1
- A_{w1} = Area of opaque wall number 1
- U_{w2} = *U*-factor of opaque wall number 2
- A_{w2} = Area of opaque wall number 2

402.1.4 Total UA Alternative

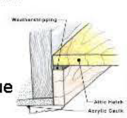
- The building envelope design is permitted to deviate from R-values or *U*-factors in Tables 402.1.1 or 402.1.3, respectively, provided the total thermal transmittance (UA) is the same or less as the very same building envelope geometry designed to code
- The calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials
- SHGC requirements shall be met

402.2.1 Ceilings with Attic Spaces

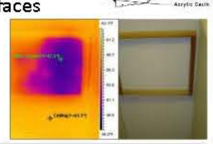


402.2.3 Access Hatches and Doors

- Access doors from conditioned to unconditioned spaces shall be:
  - Weather-stripped
  - Insulated to the equivalent R-value on the surrounding surfaces



•A wood framed baffle or retainer is required to be provided when loose fill insulation is installed



402.2.4 Mass Walls

- For residential purposes above-grade walls are:
  - Concrete block
  - Concrete
  - Insulated concrete form (ICF)
  - Masonry cavity
  - Brick (other than brick veneer)
  - Earth
    - Adobe
    - Compressed earth block
    - Rammed earth
  - Solid timber/logs

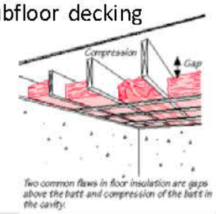
Figure 62: IECC Intermediate Overview part 5

402.2.5 Steel Framing

- Steel framing ceilings, walls and floors shall meet the insulation requirements of Table 402.2.5 or the *U*-factor requirements in Table 402.1.3

402.2.6 Floors

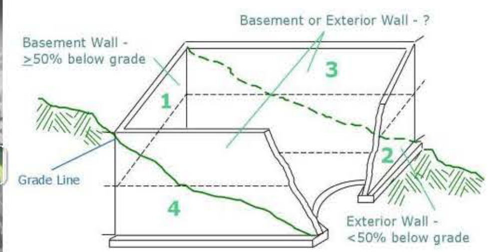
- Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking



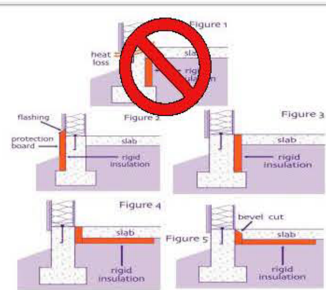
402.2.7 Basement Walls

- Defined as walls greater than or equal to 50 percent below grade
- Insulate from the top of the basement wall down 10 feet below grade or to the basement floor, whichever is less

402.2.7 Basement Walls



402.2.8 Slab-on-grade Floors



402.2.9 Crawl Space Walls

- Criteria:
- Must be insulated to the R-value specified in the energy code
- May not have ventilation openings that communicate directly with outside air
- Must be mechanically ventilated or supplied with conditioned air
- Exposed earth floors must be covered with an approved vapor retarder material, which extends up the stem wall and is sealed and taped to the wall

Figure 63: IECC Intermediate Overview part 6

Thermally Isolated Sunrooms

- Requirements:
  - Separate zones for heating and cooling or conditioned by separate equipment
  - Must maintain thermal isolation
    - Thermal Isolation – Physical and space conditioning separation from conditioned spaces
  - Minimum wall R-value shall be R-13 (Section 402.2.11)
  - Minimum ceiling R-value shall be R-19 in zones 1-4 and R-24 in zones 5-8 (Section 402.2.11)
  - The glass used must have a maximum *U*-factor of 0.50 inches and skylights *U*-factor of 0.75 in climate zones 4-8 (Section 402.3.5)

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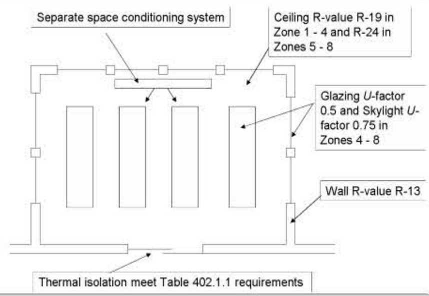
Thermally Isolated Sunroom



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402.3 Fenestration

- 402.3.1 U-factor
  - Area weighted average of fenestration products may be used to satisfy the U-factor requirements
  - Area weighted average of fenestration products with more than 50 percent glazing may be used to satisfy the SHGC requirements

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Fenestration Exemptions

- Up to 15 ft^2 of glazed fenestration per dwelling unit can be exempted from *U*-factor and SHGC requirements
- One side-hinged opaque door assembly up to 24 square feet shall be exempt from U-factor and SHGC requirements

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Solar Heat Gain Coefficient

The SHGC measures how well a window or translucent product blocks heat caused by sunlight. SHGC is expressed as a number between 0 and 1. The lower the number, the lower the amount of heat that passes into the building through the glazing.

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402.4 Air Leakage

- 402.4.1 – Building thermal envelope
  - Durably sealed to limit infiltration
- 402.4.2 – Air Sealing and Insulation
  - Building envelope air tightness and insulation shall be demonstrated in one of two ways
    - 402.4.2.1 Testing option
    - 402.4.2.2 Visual inspection option
      - Follows Table 402.4.2 and where required by the code official, an approved party independent from the installer of the insulation shall inspect the air barrier and insulation

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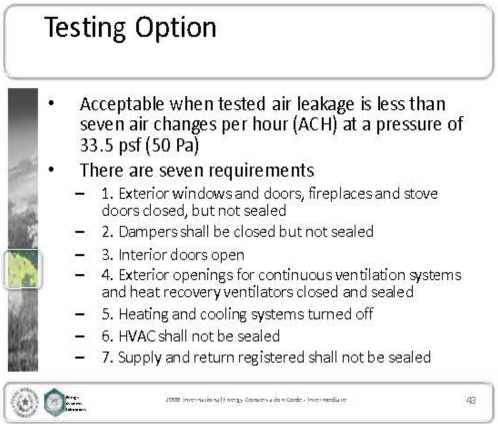
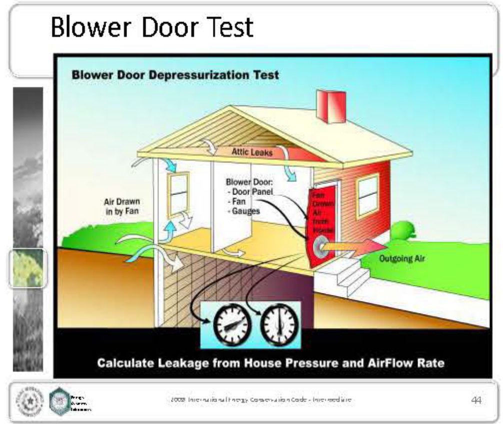
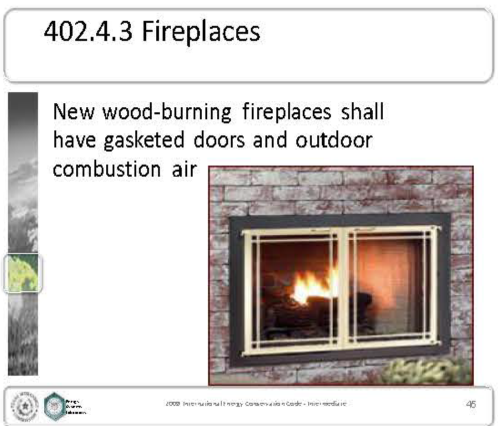
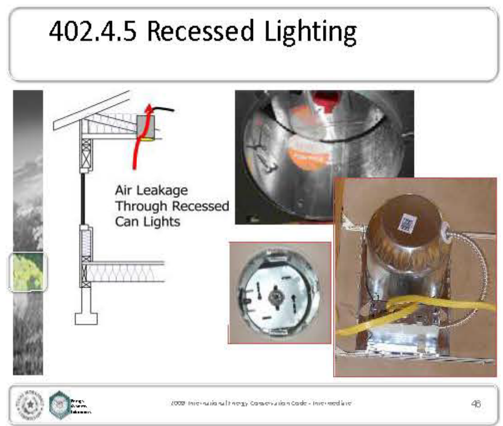
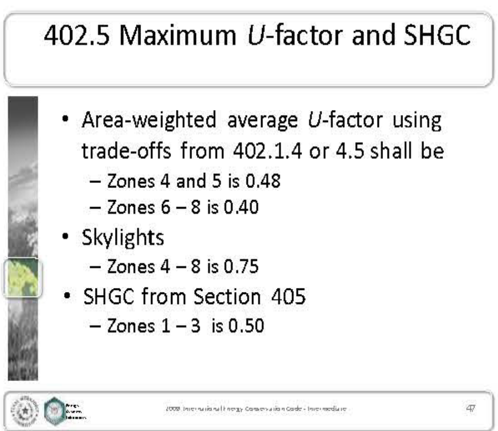
Figure 64: IECC Intermediate Overview part 7











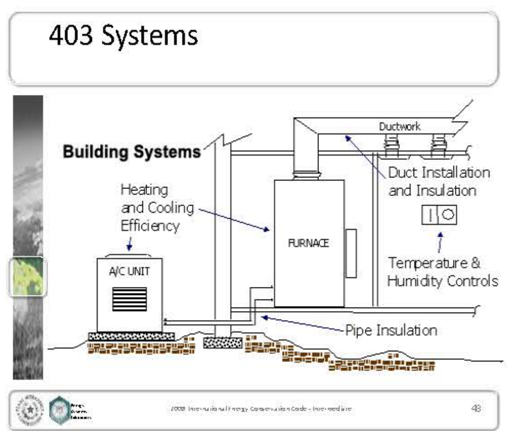
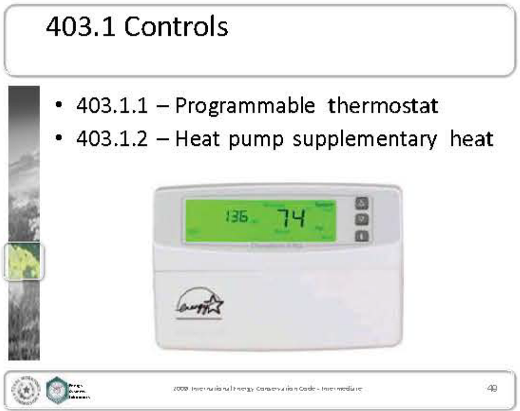
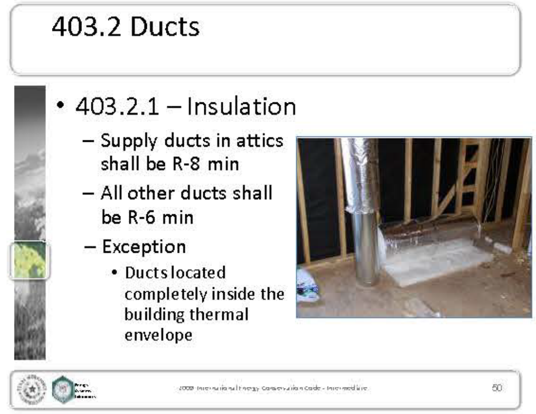
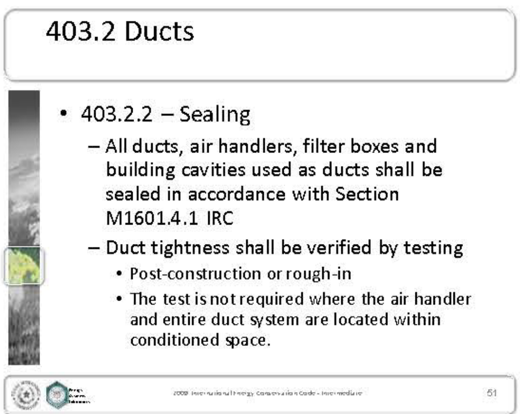
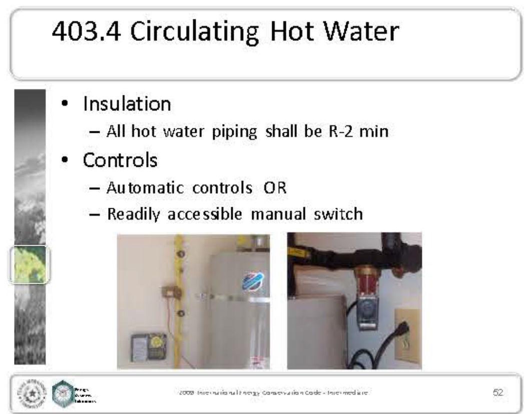


Figure 65: IECC Intermediate Overview part 8









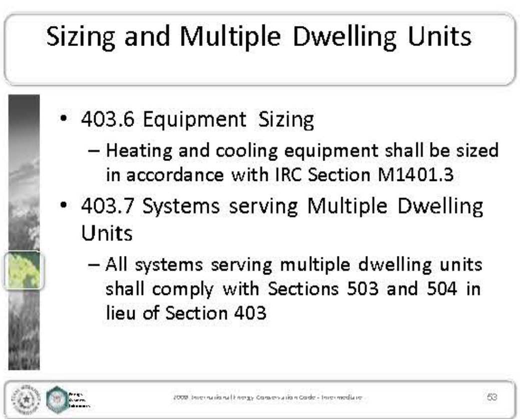


Figure 66: IECC Intermediate Overview part 9

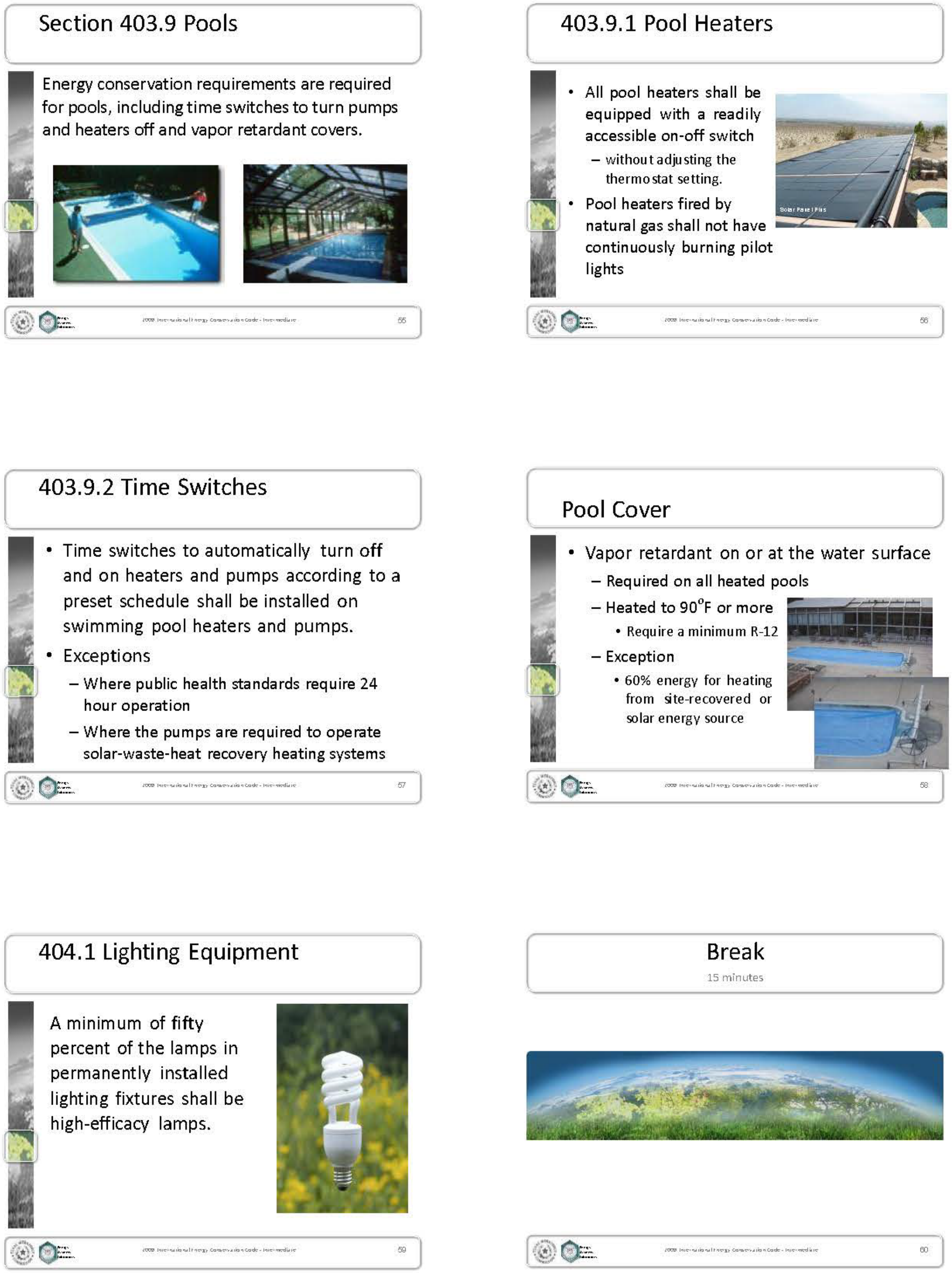
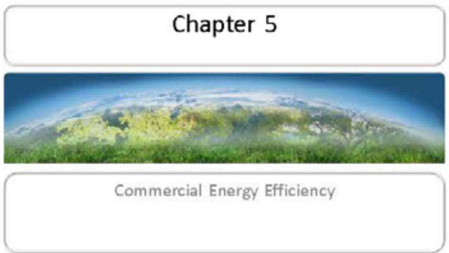
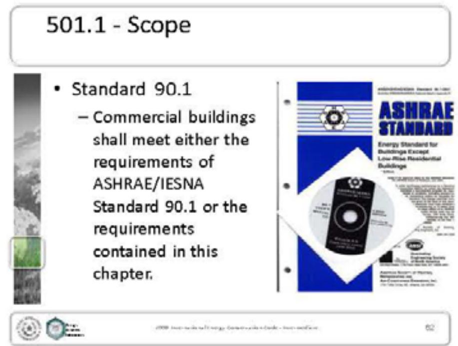
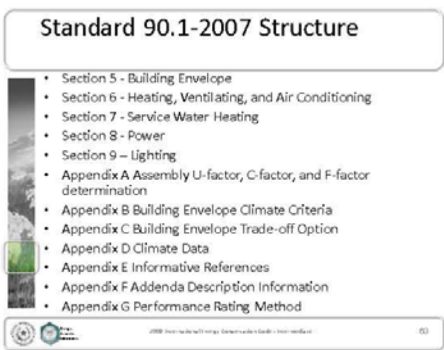
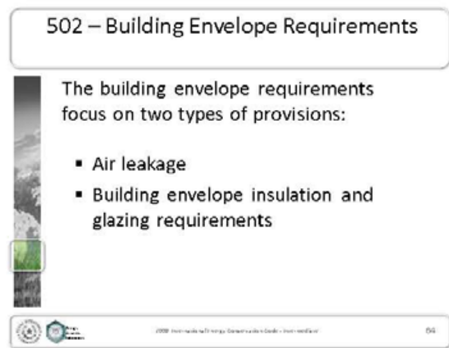


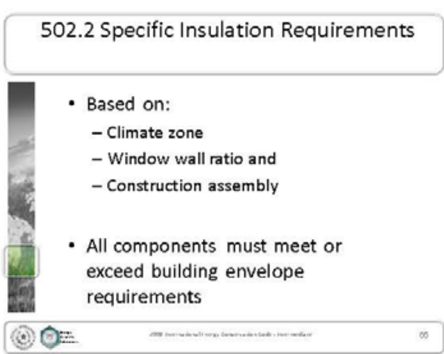
Figure 67: IECC Intermediate Overview part 10











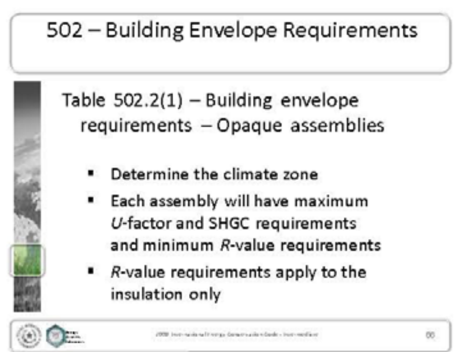


Figure 68: IECC Intermediate Overview part 11

502 – Building Envelope Requirements

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	R-15ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci
Metal buildings (with R-5 thermal blocks[a, b])	R-19	R-19	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-19	R-19	R-13 + R-19	R-19 + R-10	R-11 + R-19	R-19 + R-10
Attic and other	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49
Walls, Above Grade																
Mass	NR	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building[b]	R-16	R-16	R-16	R-16	R-19	R-19	R-19	R-19	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci
Metal framed	R-13	R-13	R-13	R-13+ 7.5ci	R-13 + R-3.8ci	R-13 + R-7.5ci	R-13 + R-7.5	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13 + R-18.8ci
Wood framed and other	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13+ R-3.8ci	R-13 + R-3.8ci	R-13 + R-3.8	R-13 + R-7.5	R-13 + R-7.5	R-13+ R-7.5ci	R-13 +7.5ci	R-13 + R-15.6ci	R-13 + 15.6ci

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502 – Building Envelope Requirements

Walls, Below Grade																
Below grade wall[d]	NR	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-7.5ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-6.3ci	R-8.3ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-14.6ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/Framing (steel/wood)	NR	NR	R-19	R-30	R-19	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	NR	R-10 for 24 in. below	NR	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 48 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below
Opaque doors																
Swinging	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50
Roll-up or sliding	U-1.45	U-1.45	U-1.45	U-1.45	U-1.45	U-1.45	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50

For SI: 1 inch = 25.4 mm.
ci = Continuous insulation. NR = No requirement.
a. When using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method. [see Tables 502.1.2 and 502.2(2)].
b. Assembly descriptions can be found in Table 502.2(2).
c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in./h · ft² · °F.
d. When heated slabs are placed below grade, below-grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.
e. Steel floor joist systems shall to be R-38.

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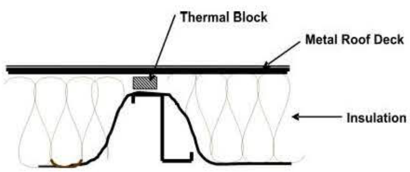
Metal Buildings - Roofs

When using R-value compliance method, a R-5 thermal block is required otherwise use the U-factor compliance method



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"Sag and Bag" Insulation Technique

- Table 502.2(1) - Roofs for metal buildings, insulation is expressed as R13 + R13
  - Detailed description is found in Table 502.2(2)
- First R-value is faced fiberglass insulation batts draped over purlins
- Second R-value is unfaced fiberglass insulation batts installed parallel to the purlins
- A minimum R-3.5 thermal spacer block is placed above the purlin/batt and roof deck is secured to the purlins

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502 – Building Envelope Requirements

502.2.7 – Opaque doors

All are required to meet the *U*-factor requirement for doors as specified in Table 502.2(1).

Includes overhead coiling and metal roll-up doors used for conditioned loading docks.

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Table 502.3 - Fenestration

- The gross wall area includes:
  - Above-grade walls
  - Band and rim joists and spandrel area between floors
  - Area of all doors and windows
    - Including those in below-grade walls

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Figure 69: IECC Intermediate Overview part 12

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
U-factor								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.0	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC-all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.
PF = Projection factor (see Section 502.3.2).
a. All others includes operable windows, fixed windows and nonentrance doors.

Skylights

A skylight *U*-factor is based on the interior surface area of the entire skylight assembly, including glazing, sash, curbing and other framing elements.

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502.4 Air Leakage

- 502.4.1 – Window and door assemblies
  - AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400
- 502.4.2 – Curtain wall, storefront glazing, and commercial entrance doors
  - ASTM E 283

2009 International Energy Conservation Code - Intermediate 75

Store Front Glazing and Curtain Walls

- If compliance approach uses other than default U-factor and/or SHGC values for glazing the designer must provide Label Certificate
- NFRC provide 3 options:
  - Pre-certified assemblies from many manufacturers
  - Site built approach, and
  - Since January 1, 2010 implemented Component Modeling Approach (CMA)
- Label Certificates are site specific

2009 International Energy Conservation Code - Intermediate 76

Component Modeling Approach

- The NFRC's new **Component Modeling Approach (CMA) Product Certification Program** enables whole product energy performance ratings for commercial (non-residential) projects. The concept behind component modeling is performance data from the three primary components that make up a fenestration product are used for obtaining an overall product performance rating.
- Three primary components used are:
  - Glazing: : Glazing optical spectral and thermal data from the International Glazing Database (IGDB)
  - Frame: Thermal performance data of frame cross-sections
  - Spacer: Keff of spacer component geometry and materials
- The Component Modeling Approach Software Tool (CMAST) establishes a set of performance libraries of approved components (frames, glass, and spacer) which can be accessed for configuring fenestration products for a project, and obtaining a U-factor, Solar Heat Gain Coefficient (SHGC), and Visible Transmittance (VT) rating for those products, which can then be reflected in a CMA Label Certificate for code compliance.

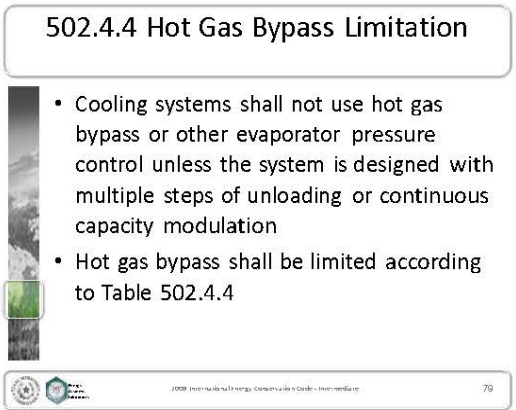
2009 International Energy Conservation Code - Intermediate 77

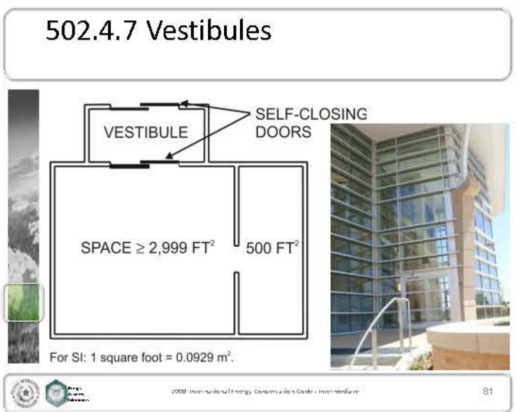
502.4.3. Sealing the Envelope

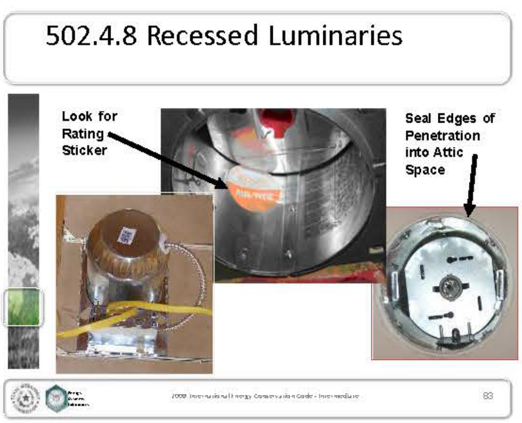
- Openings and penetrations in the envelope shall be sealed with caulking or closed with gasketing
- Joints and seams shall be sealed, taped or covered with a moisture vapor-permeable material
- Sealing shall allow for expansion and contraction

2009 International Energy Conservation Code - Intermediate 78

Figure 70: IECC Intermediate Overview part 13







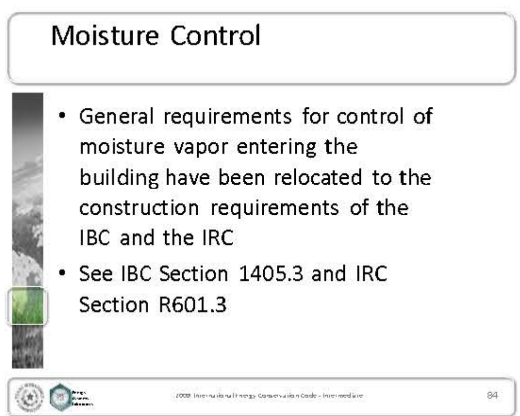


Figure 71: IECC Intermediate Overview part 14

503 Building Mechanical Systems

- Seven key elements to ensure HVAC system design is efficient:
  - Equipment efficiency
  - Proper equipment sizing and selection
  - Distribution losses
  - Transmission losses
  - Controls
  - Free-cooling
  - Heat recovery

2009 International Energy Conservation Code - Intermediate 85

503.2.1 Calculation of Loads

- Designers must perform heating and cooling load calculations before sizing and selecting HVAC
- HVAC systems must be sized based on the heating and cooling loads calculated in Section 503.2.1
- When the cooling load is predominant the system must be sized to not exceed that load

2009 International Energy Conservation Code - Intermediate 86

503.2.2 Equipment and System Sizing

- "Shall not exceed the loads calculated."
- Equipment selected to meet space cooling loads must select capacity for heating based on smallest size within available equipment options
- Standby equipment to have controls and devices to operate automatically when primary equipment is not operating
- Multiple units with combined capacities that exceed design load shall have controls to sequence operation

2009 International Energy Conservation Code - Intermediate 87

Equipment Efficiency

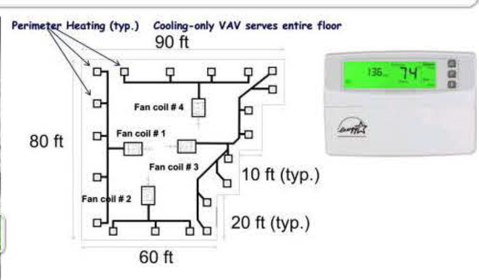
- Table 503.2.3(1) Unitary Air Conditioners & Condensing Units
- Minimum Efficiency Requirements

TABLE 503.2.3(1)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air conditioners, Air cooled	< 65,000 Btu/h	Split system	13.0 SEER	AHRI 210/240
		Single package	13.0 SEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	10.3 EER (before Jan 1, 2010) 11.2 EER (as of Jan 1, 2010)	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	9.7 EER (before Jan 1, 2010) 11.0 EER (as of Jan 1, 2010)	AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split system and single package	9.5 EER 9.7 IPLV (before Jan 1, 2010) 10.0 EER 9.7 IPLV (as of Jan 1, 2010)	
	≥ 760,000 Btu/h	Split system and single package	9.2 EER 9.4 IPLV (before Jan 1, 2010) 9.7 EER 9.4 IPLV (as of Jan 1, 2010)	

2009 International Energy Conservation Code - Intermediate 88

503.2.4.1 Thermostatic Controls



2009 International Energy Conservation Code - Intermediate 89

503.2.4.3 Off-hour Controls

- Each zone shall have thermostatic setback controls
  - Automatic time clock OR
  - Programmable control system
- Exceptions
  - Zones that operate continuously
  - Zones with a full HVAC load demand not exceeding 6,800 Btu/h (2 kW) that has a readily accessible manual shutoff switch

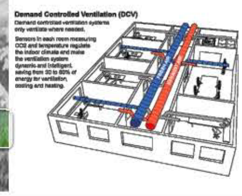
2009 International Energy Conservation Code - Intermediate 90

Figure 72: IECC Intermediate Overview part 15

Controls

- 503.2.4.4 – Shutoff damper controls
  - Motorized dampers required on outdoor air supply and exhaust ducts
  - Exceptions
- 503.2.4.5 – Snow melt system controls
  - Automatic controls that meet both
    - Shut of when the pavement temperature is above 50°F and no precipitation is falling **and**
    - An automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F

Demand Control Ventilation



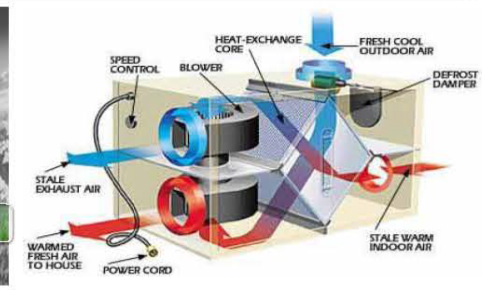
- 503.2.5.1 – Demand control ventilation
  - A ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy

Energy Recovery Ventilation System

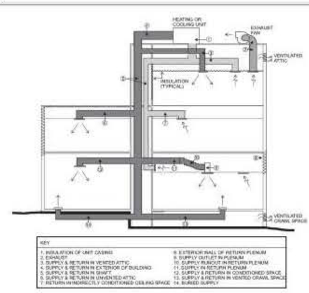
503.2.6 – Energy Recovery Ventilation System

Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, pre-cooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space either directly or as part of an HVAC system

Energy Recovery Ventilation System



503.2.7 Duct and Plenum Insulation and Sealing



503.2.8 Piping Insulation

Piping serving as part of heating or cooling systems must be insulated according to Table 503.2.8.

TABLE 503.2.8
MINIMUM PIPE INSULATION
(thickness in inches)

FLUID	NOMINAL PIPE DIAMETER ≤ 1.5"	NOMINAL PIPE DIAMETER > 1.5"
Steam	1½	3
Hot water	1½	2
Chilled water, brine or refrigerant	1½	1½

Figure 73: IECC Intermediate Overview part 16

503.2.9 HVAC Completion

- 503.2.9.1 – Air system balancing
  - In accordance with the IMC
- 503.2.9.2 – Hydronic system balancing
  - Individual hydronic heating and cooling coils to be equipped with means for balancing and pressure test connectors
- 503.2.9.3 - Manuals

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503.3 Simple HVAC Systems

Simple systems are served by unitary or packaged HVAC equipment, each serving one zone and controlled by a single thermostat in the zone served. It also applies to two-pipe heating system, where no cooling system is installed.

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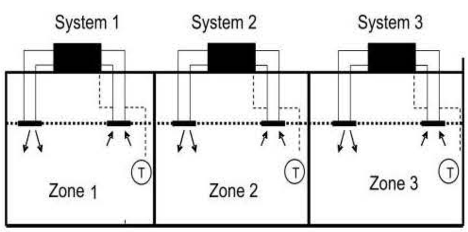
Simple Systems



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503.3.1 Economizers

TABLE 503.3.1(1)
ECONOMIZER REQUIREMENTS

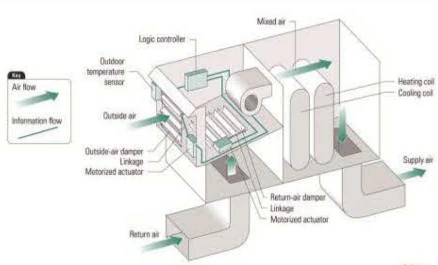
CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, 2A, 7, 8	No requirement
2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B	Economizers on all cooling systems ≥ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.293 W.

a. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20 percent of its air economizer capacity, whichever is greater.

100

Economizer



101

503.4. Complex Systems

- Anything not covered in Section 503.3
- Includes:
  - Systems serving multiple zones
  - Hydronic steam heating and water chilling packages
  - Variable air volume (VAV) systems
  - Two-pipe changeover
  - Four-pipe systems
  - Hydronic (water loop) heat pump systems

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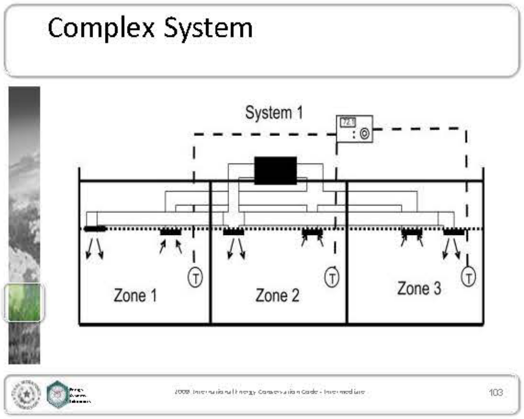
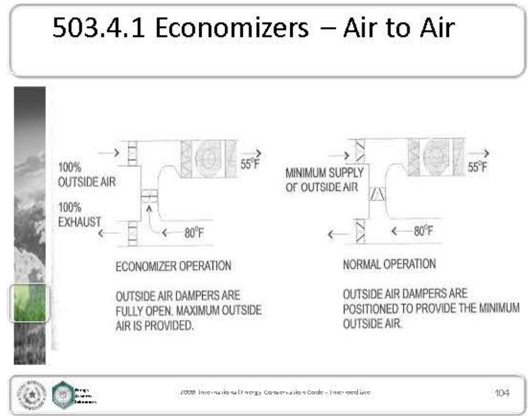
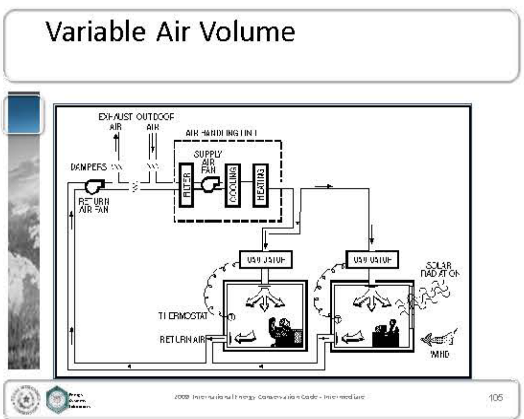
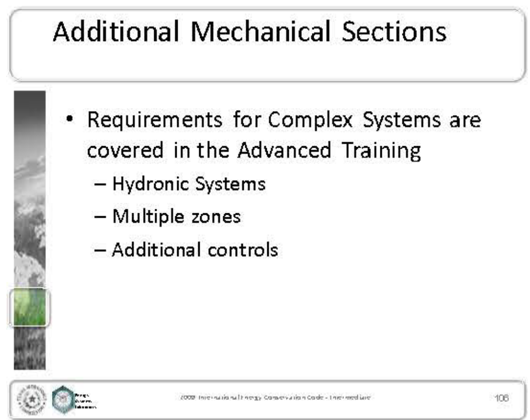
Figure 74: IECC Intermediate Overview part 17









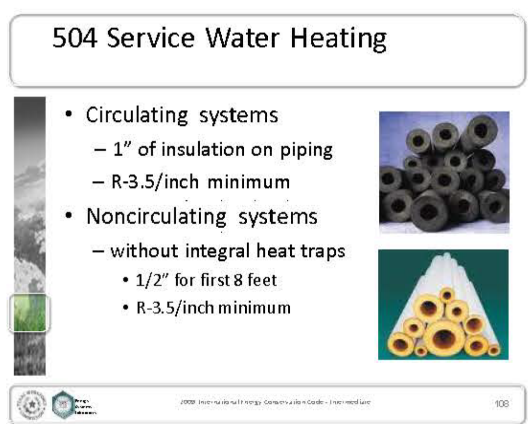
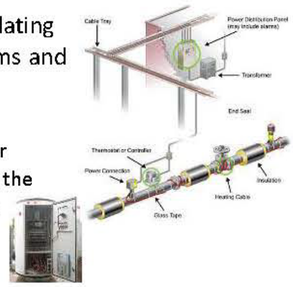


Figure 75: IECC Intermediate Overview part 18

504.6 Hot Water Controls

- Automatic circulating hot water systems and heat trace
  - Turned off automatically or manually when the system is not in operation



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504.7 Pools

- Pool Heaters
  - Readily accessible On/Off switch on heater
  - Natural gas heaters shall not have continuously burning pilot lights
- Time switches
  - All – Heated and Unheated
  - Exception
    - Where 24 hour operation is required for public health standards
    - Where pumps are required to operate solar and waste-heat recovery pool heating systems

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504.7.3 Pool Covers

- Pool Covers
  - Required on heated pools
  - 90°F requires R-12 minimum
  - Vapor retardant, on or at the pool surface
  - Exception
    - 60% of the energy for heating is from site-recovered or site-solar energy

111

505 Electrical Power and Lighting Systems

- The lighting requirements focus on these elements:
  - Controls
  - Light reduction methods
  - Tandem wiring
  - Interior and exterior lighting power

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505 – Electrical Power and Lighting Systems

- 505.1 – General
  - The lighting requirements apply to the design of:
    - New lighting systems in conditioned or unconditioned spaces
    - Altered components/systems as part of alteration
- Additional requirements for controls, tandem wiring and power requirements are covered in the Advanced Training

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Total Building Performance

- Section 506 Total Building Performance will be covered in the Advance Training

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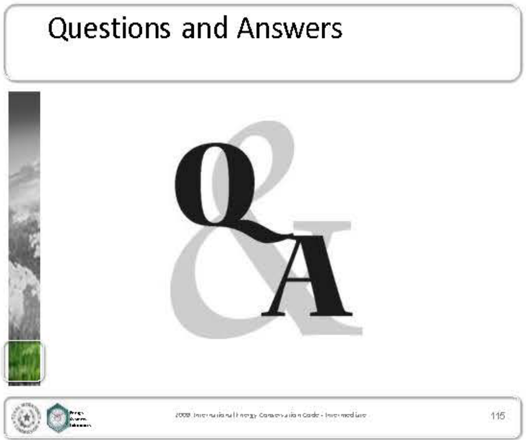
Figure 76: IECC Intermediate Overview part 19



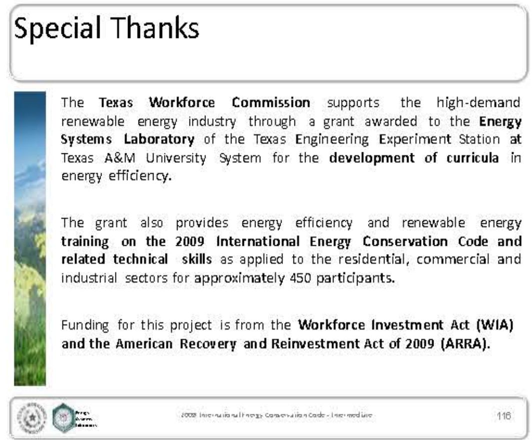


Figure 77: IECC Intermediate Overview part 20

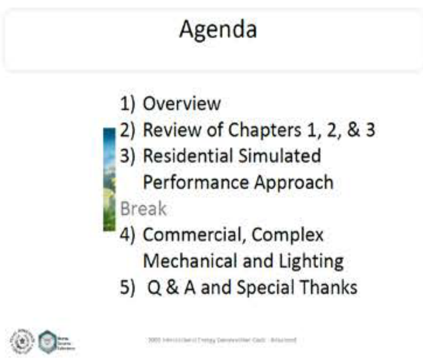
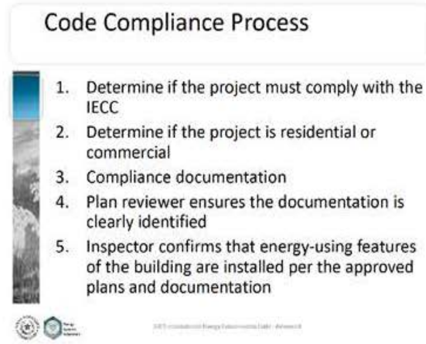
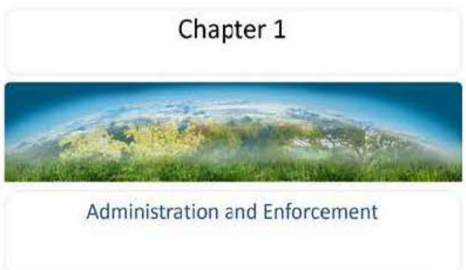


Figure 78: IECC Advanced Overview, part 1





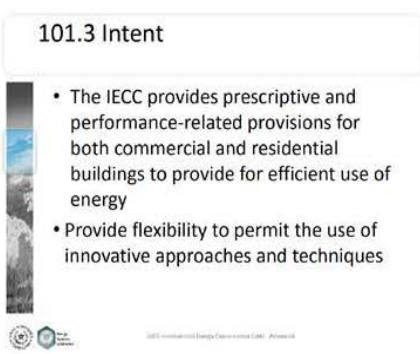
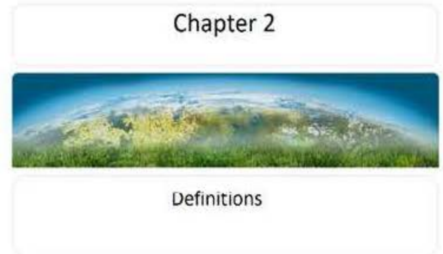
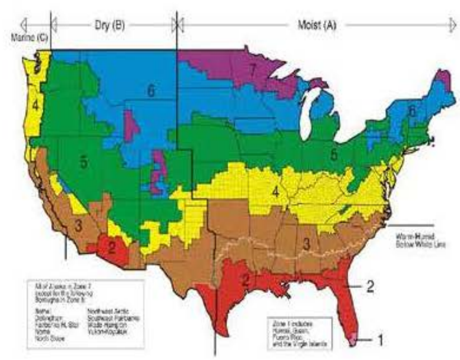
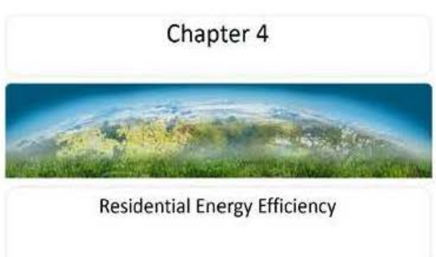


Figure 79: IECC Advanced Overview, part 2







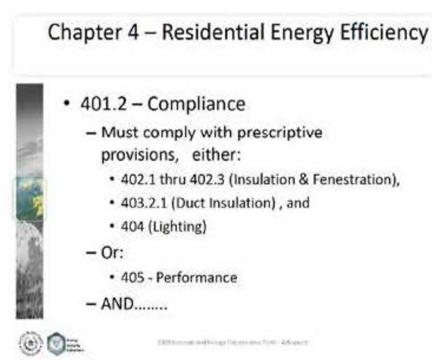
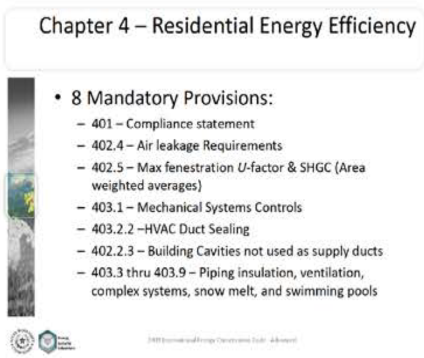
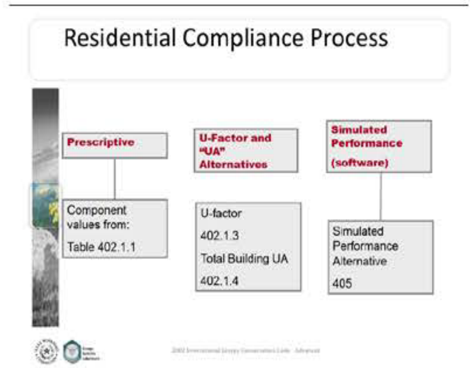
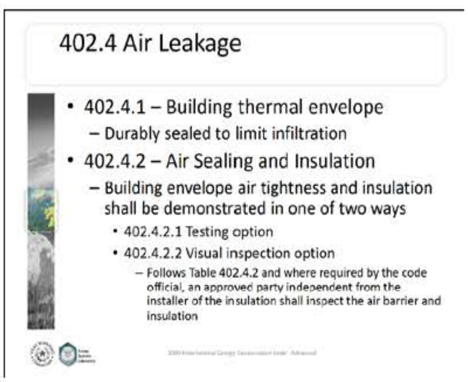
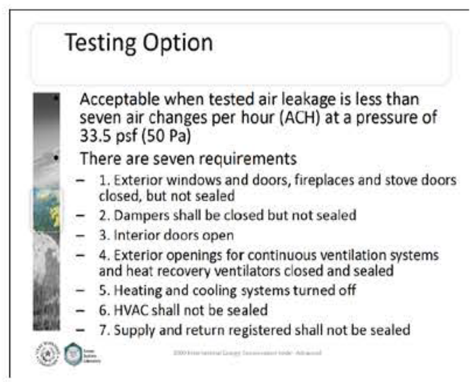


Figure 80: IECC Advanced Overview, part 3









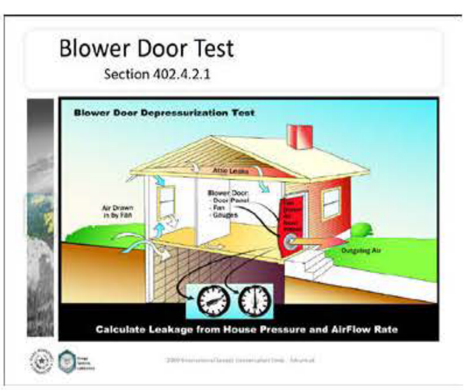
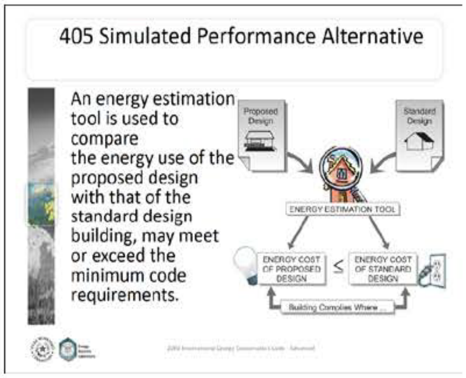
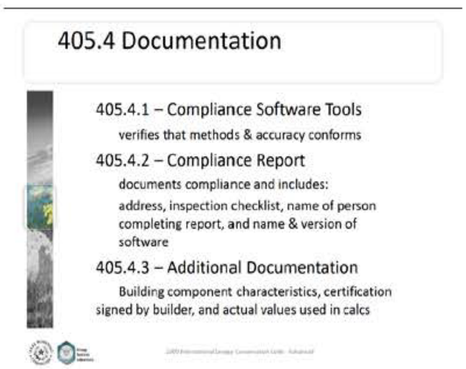
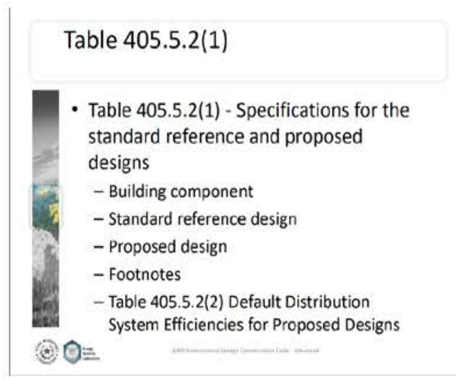


Figure 81: IECC Advanced Overview, part 4







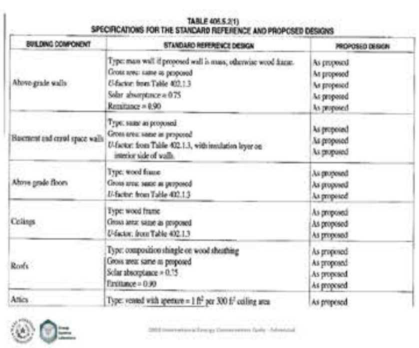
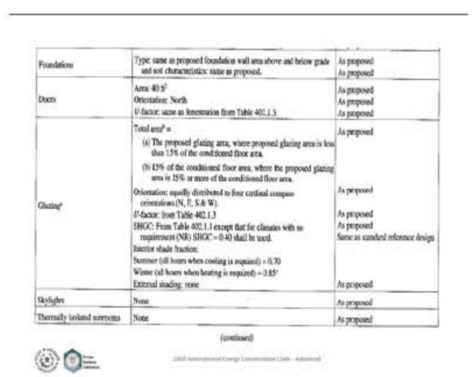


TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

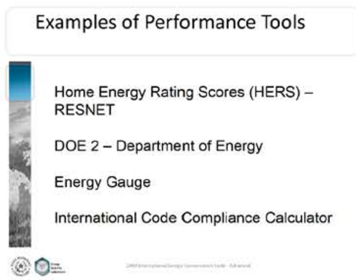
BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass wall if proposed wall is mass; otherwise wood frame. Gross area: same as proposed U-factor: from Table 402.1.3 Solar absorptance = 0.75 Remittance = 0.90	As proposed As proposed As proposed As proposed As proposed
Basement and crawl space walls	Type: same as proposed Gross area: same as proposed U-factor: from Table 402.1.3, with insulation layer on interior side of walls.	As proposed As proposed As proposed
Above-grade floors	Type: wood frame Gross area: same as proposed U-factor: from Table 402.1.3	As proposed As proposed As proposed
Ceilings	Type: wood frame Gross area: same as proposed U-factor: from Table 402.1.3	As proposed As proposed As proposed
Roofs	Type: composition shingle on wood sheathing Gross area: same as proposed Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed
Attics	Type: vented with aperture = 1 ft² per 300 ft² ceiling area	As proposed

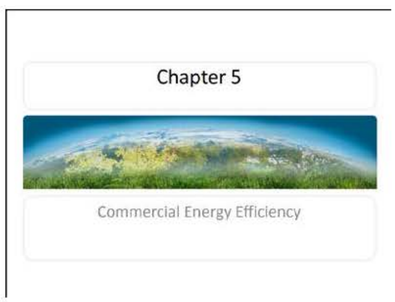


Foundations	Type: same as proposed foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed As proposed
Doors	Area: 40 ft² Orientation: North U-factor: same as fenestration from Table 402.1.3	As proposed As proposed As proposed
Glazing[a]	Total area[b] = (a) The proposed glazing area; where proposed glazing area is less than 15% of the conditioned floor area. (b) 15% of the conditioned floor area; where the proposed glazing area is 15% or more of the conditioned floor area. Orientation: equally distributed to four cardinal compass orientations (N, E, S & W). U-factor: from Table 402.1.3 SHGC: From Table 402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used. Interior shade fraction: Summer (all hours when cooling is required) = 0.70 Winter (all hours when heating is required) = 0.85[c] External shading: none	As proposed As proposed As proposed As proposed Same as standard reference design As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed

(continued)

Figure 82 : IECC Advanced Overview, part 5





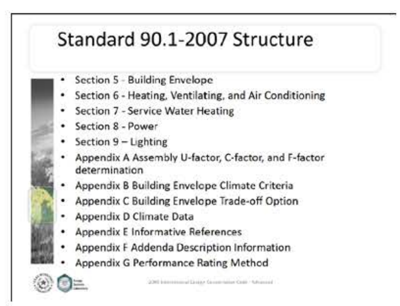
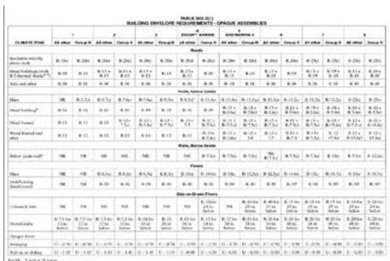
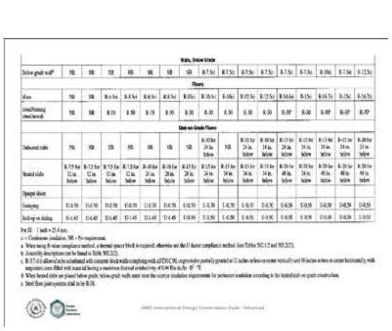
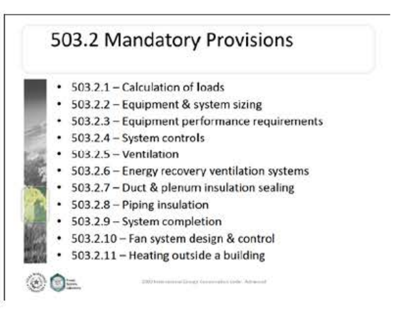


Figure 83: IECC Advanced Overview, part 6







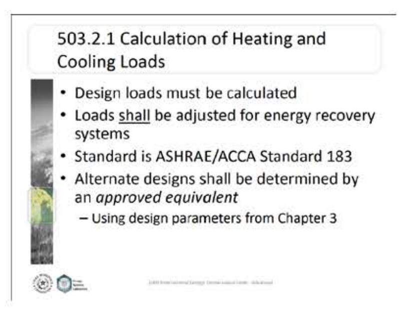


Figure 84: IECC Advanced Overview, part 7

503.2.2 Equipment and System Sizing

- "Shall not exceed the loads calculated."
- Single piece equipment with both heating & cooling must satisfy this provision for one function – other function as small as possible within available equipment options
  - Exceptions:
    - Required standby equipment to have controls to operate automatically when primary equipment is not operating
    - Multiple units with combined capacities that exceed design load shall have controls to sequence operation

503.2.3 – Equipment performance requirements

- Equipment efficiencies listed in 7 tables
- Single phased air cooled A/C & heat pumps <65k Btuh set by National Appliance Energy Conservation Act of 1987 (NAECA)
- All efficiencies verified by *approved* certification programs
- Mixing manufacturer's components (indoor/outdoor coils) to be verified with calculations and supporting data

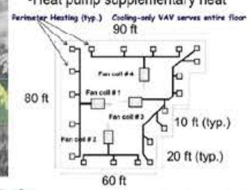
503.2.4 HVAC System Controls

Each heating and cooling system shall be provided with:

1. Thermostatic Controls
2. Set point overlap restriction
3. Off-hour controls
4. Setback capabilities
5. Automatic setback and shutdown capabilities
6. Shut off damper controls
7. Snow melt system controls

503.2.4.1 Thermostatic Controls

- One stat each zone – must respond to temp in zone
- Humidification/dehumidification requires minimum one humidistat
- Heat pump supplementary heat



503.2.4.2 Set point overlap restriction
503.2.4.3 Off-hour controls

- T-stats controlling both heat and cool must have 5 degree F minimum deadband
- Each zone must be controlled by automatic time clock or programmable controls
- T-stats must have setback capability to maintain min of 55 degree F or max 85 degree F
- Must have automatic time clock or programmable controls
  - For 7 different daily schedules per week
  - Retain programming for 10 hours when power lost
  - 2 hour over ride capability

Controls

- 503.2.4.4 – Shutoff damper controls
  - Motorized dampers required on outdoor air supply and exhaust ducts
  - Exceptions
- 503.2.4.5 – Snow melt system controls
  - Automatic controls that meet both
    - Shut of when the pavement temperature is above 50°F and no precipitation is falling **and**
    - An automatic or manual control that will shutoff when the outdoor temperature is above 40°F

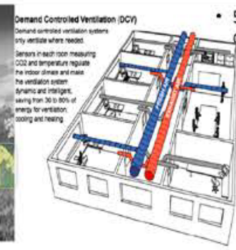
Figure 85: IECC Advanced Overview, part 8

503.2.5 Ventilation

Ventilation – natural or mechanical - must be provided per Chapter 4 IMC

Where mechanical ventilation is provided, system must have capability to reduce OA supply to minimum required by Chapter 4 IMC

Demand Control Ventilation



- 503.2.5.1 – Demand control ventilation
  - A ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy

503.2.6 Energy recovery ventilation systems

Individual fan systems with both:

Design supply air ≥ 5,000 cfm, and

Min OA ≥ 70% of design supply air, then

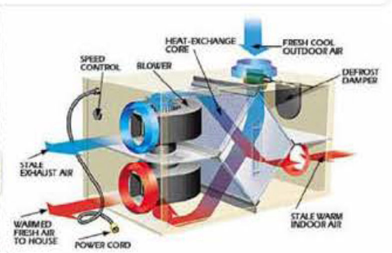
Energy recovery system required

Energy Recovery Ventilation System

503.2.6 – Energy Recovery Ventilation System

Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, pre-cooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space either directly or as part of an HVAC system

Energy Recovery Ventilation System



503.2.7 Duct and plenum insulation and sealing

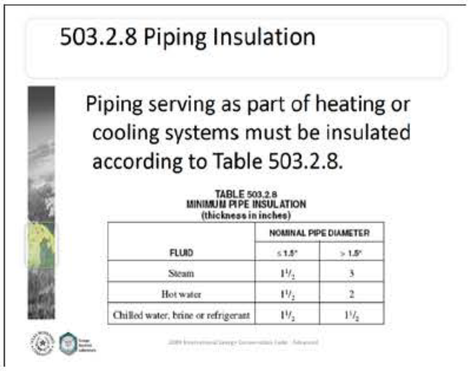
All supply and return ducts must be insulated
- R-5 in unconditioned spaces
- R-8 when outside the building

Air handlers and filter boxes joints and seams sealed to comply with IMC 603.9

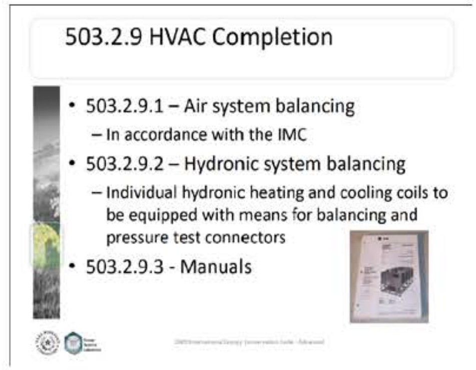
All duct system joints and seams must be sealed with *approved* mastics, tapes

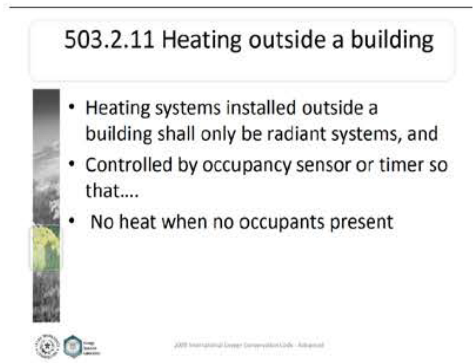
High pressure duct systems (> 3 inches w.g.) must be leak tested

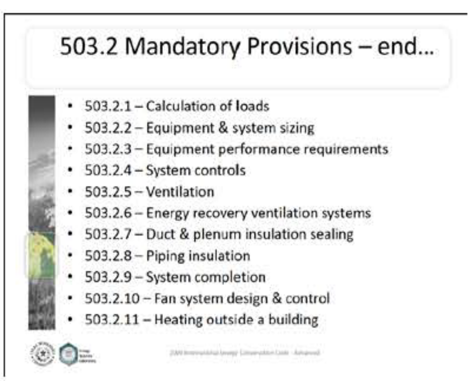
Figure 86: IECC Advanced Overview, part 9



FLUID	NOMINAL PIPE DIAMETER ≤ 1.5"	NOMINAL PIPE DIAMETER > 1.5"
Steam	1½	3
Hot water	1½	2
Chilled water, brine or refrigerant	1½	1½







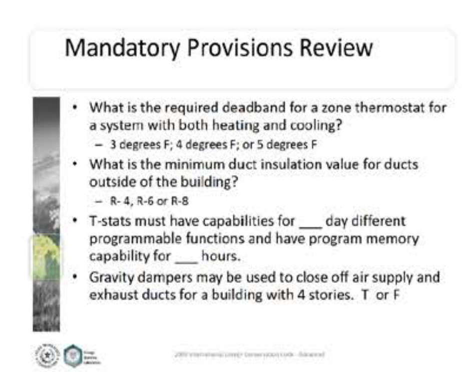


Figure 87: IECC Advanced Overview, part 10

503 Building Mechanical Systems

- Heating, Cooling and Ventilation Equipment shall comply with either:
  - 503.3 – Simple Systems, or
  - 503.4 – Complex Systems.
- There are 11 mandatory requirements applicable to both simple and complex systems

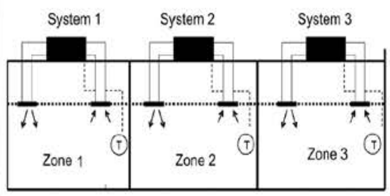
503.3 Simple HVAC Systems

Simple systems are:

•Unitary or packaged HVAC equipment,
•Each serving one zone, and
•Each controlled by a single thermostat in the zone served.

•Also applies to two-pipe heating system, without a cooling system

Simple Systems



503.3.1 Economizers

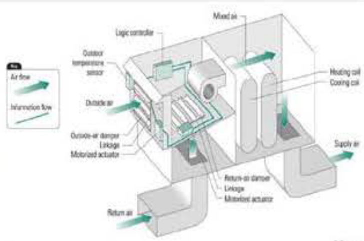
Economizers required for both simple and complex systems; exception for improved efficiencies

TABLE 503.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, 2A, 7, 8	No requirement
2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B	Economizers on all cooling systems ≥ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.293 W.
a. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20 percent of its air economizer capacity, whichever is greater.

Economizer

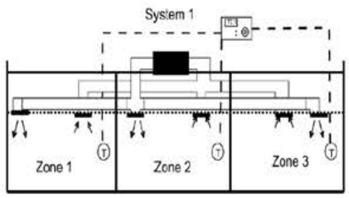


503.4. Complex Systems

- Anything not covered in Section 503.3
- Includes:
  - Systems serving multiple zones
  - Hydronic steam heating and water chilling packages
  - Variable air volume (VAV) systems
  - Two-pipe changeover
  - Four-pipe systems
  - Hydronic (water loop) heat pump systems

Figure 88: IECC Advanced Overview, part 11

Complex System



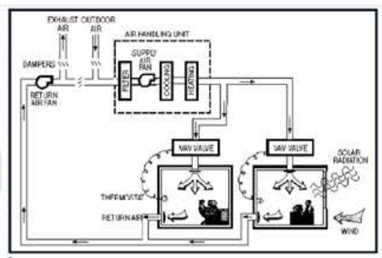
503.4. Complex Systems

- 503.4.1 - Economizers
- 503.4.2. – Variable air-volume (VAV) fan control
- 503.4.3 – Hydronic systems
  - Hydronic (water loop) heat pump systems
    - w/ several sub items
- 503.4.4 – Heat rejection equipment fan speed control
- 503.4.5 – Requirements for complex mechanical systems serving multiple zones
- 503.4.6 – Heat recovery for service water heating

503.4.2 Variable Air Volume (VAV) Fan Control

- Individual VAV fan motors ≥10 Hp (7.5 kW)
  - Driven by mechanical or electrical variable speed drive,
  - **or**
  - Have controls or devices resulting in a fan motor demand ≤50% of the design wattage at 50% of design airflow when static pressure set point = 1/3 of the total design static pressure

Variable Air Volume



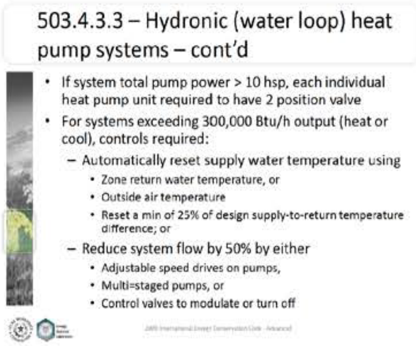
503.4.3 Hydronic Systems Controls

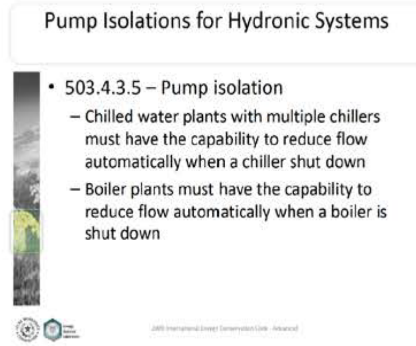
- 503.4.3.1 – Three-pipe systems
  - PROHIBITED
- 503.4.3.2 – Two-pipe changeover system
  - Dead band between changeover of 15°F outside air temperatures
  - Allow operation in one mode for at least 4 hours before changing over to the other mode
  - Allow heating and cooling supply temperatures at the changeover to be no more than 30°F apart

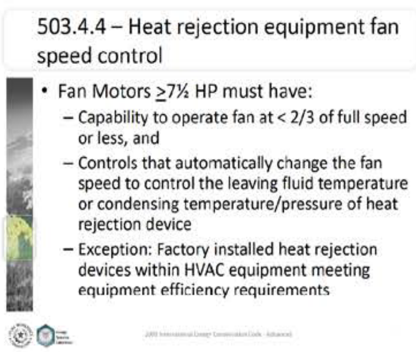
503.4.3.3 – Hydronic (water loop) heat pump systems – minimize heat loss

- Temperature dead band of 20 degrees between heat rejection and heat addition
- Heat rejection for climate zones 3 & 4
  - Closed-circuit cooling tower used directly – bypass valve or low leakage dampers required
  - Open-circuit cooling tower used directly – automatic valve required
  - Open- or closed-circuit tower used w/ heat exchanger – turn off circulation pump
- Heat rejection for climate zones 5 – 8
  - Open/closed-circuit tower, heat exchanger required – shutdown pump & provide automatic valve

Figure 89: IECC Advanced Overview, part 12







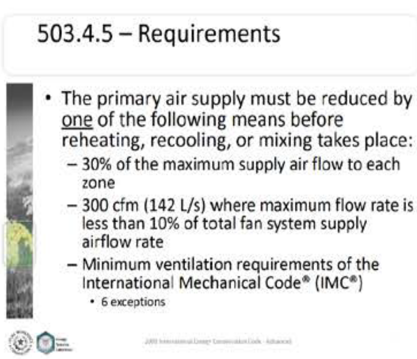
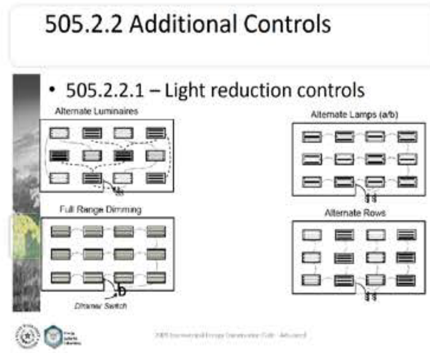


Figure 90: IECC Advanced Overview, part 13

Figure 91: IECC Advanced Overview, part 14



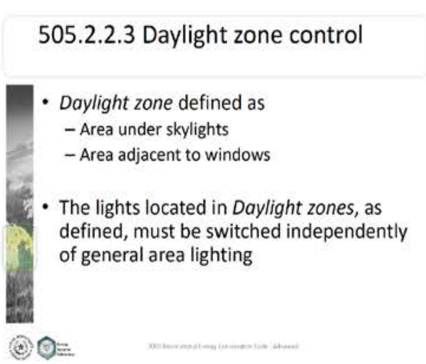


Figure 92: IECC Advanced Overview, part 15

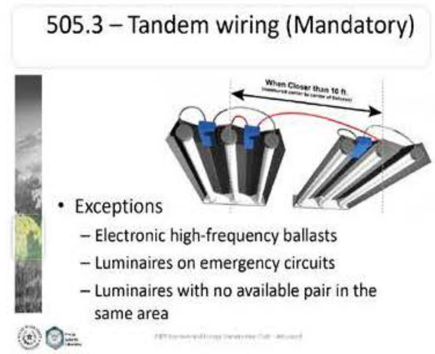


TABLE 505.5.2
INTERIOR LIGHTING POWER ALLOWANCES

LIGHTING POWER DENSITY	
Building Area Type[a]	(W/ft^2)
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare—clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multifamily	0.7

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Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/Fire Station	1.0
Post Office	1.1
Religious Building	1.3
Retail[b]	1.5
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

For SI: 1 foot = 304.8 mm, 1 watt per square foot = $W/0.0929 m^2$.
a. In cases where both a general building area type and a more specific building area type are listed, the more specific building area type shall apply.
b. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed

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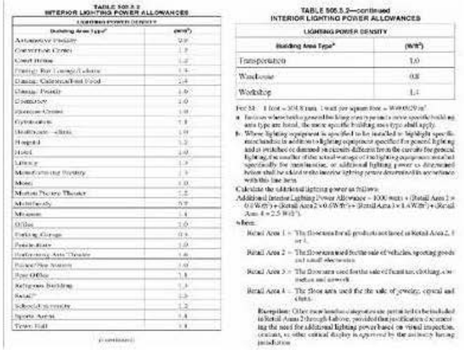
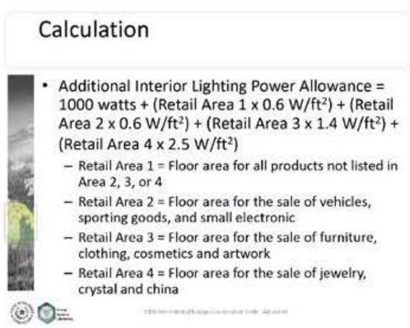
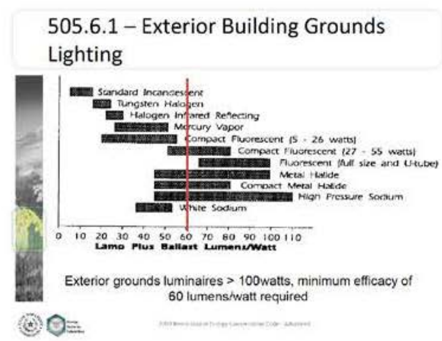
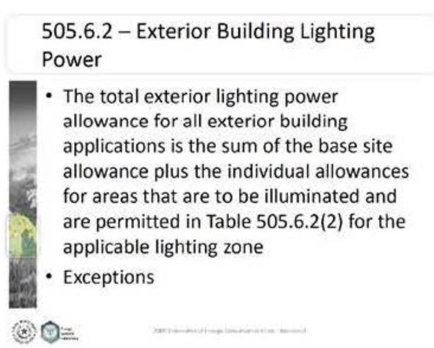
Figure 93: IECC Advanced Overview, part 16









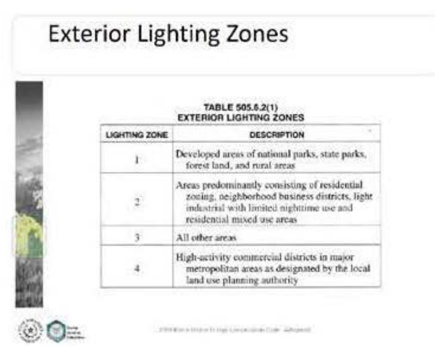
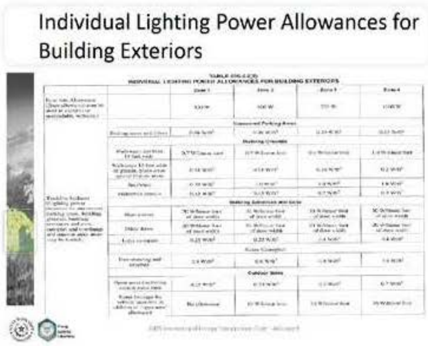
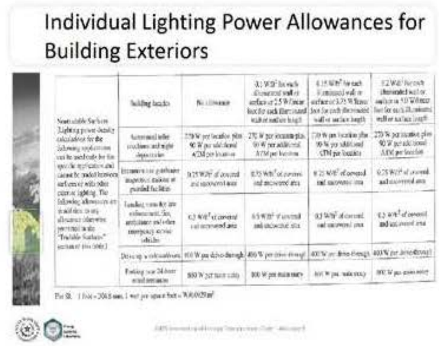


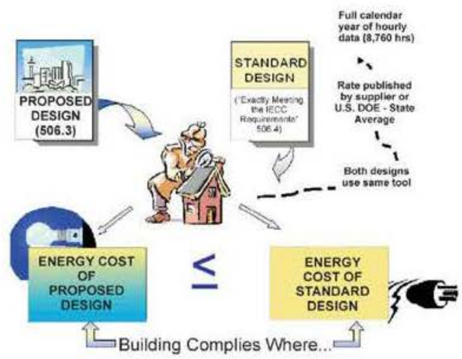
TABLE 505.6.2(1)
EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

Figure 94: IECC Advanced Overview, part 17







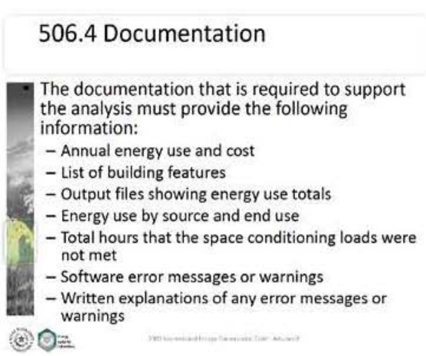


Figure 95: IECC Advanced Overview, part 18

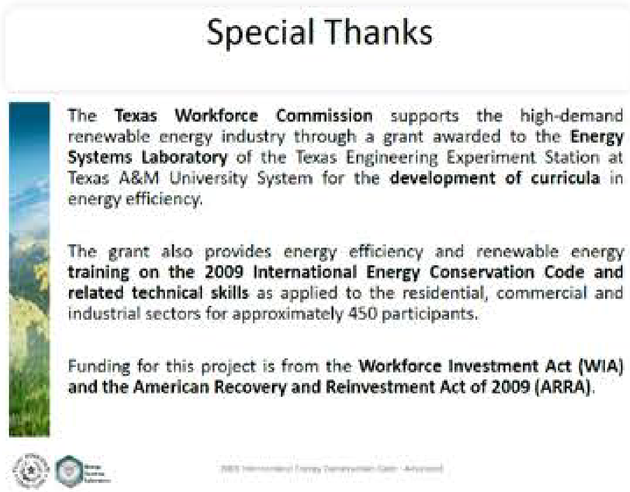


Figure 96: IECC Advanced Overview, part 19

2009 IECC FUNDAMENTALS RESIDENTIAL

Based on the 2009 International Energy Conservation Code®

Energy Systems Laboratory
Texas Engineering Experiment Station
Texas A&M University System

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SEMINAR GOAL

The goal of this seminar is for participants to apply the 2009 IECC in order to increase the efficient use of energy in the construction of new residential buildings and alterations to existing residential buildings.

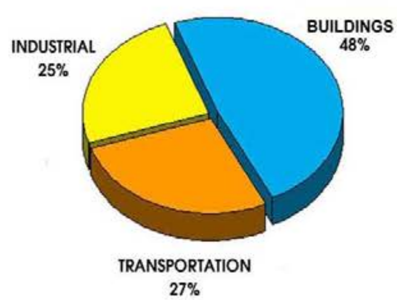
OBJECTIVES

Upon completion of this seminar, participants will be able to:

- Locate general topics in the 2009 IECC.
- Locate applicable tables in the 2009 IECC for specific situations.
- Apply code requirements to real-world situations.
- Explain the intent behind a code requirement.
- Identify borderline scenarios as compliant or noncompliant.
- Identify essential code compliancies for designing energy-efficient building thermal envelopes, energy-efficient mechanical design principles, and electrical lighting systems in residential construction.

INTERNATIONAL ENERGY CONSERVATION CODE

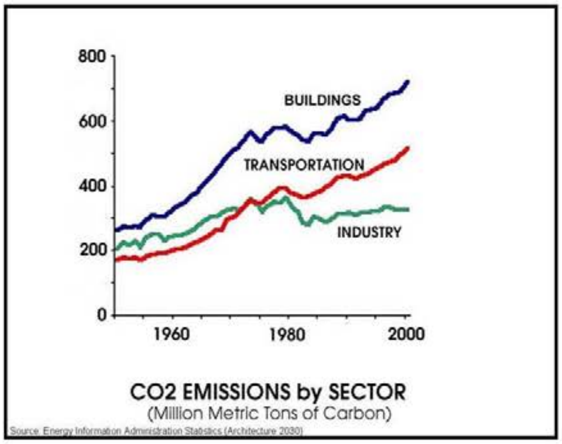
- Recognized as the national model energy code of choice for U.S. cities, counties, and states that adopt codes
- Cited throughout Federal law for national private and public housing initiatives
- Serves as the basis for federal tax credits for energy efficient homes, energy efficiency standards for federal residential buildings, and manufactured housing



U.S. ENERGY CONSUMPTION

Source: Energy Information Administration Statistics (Architecture 2030)

Figure 97: IECC Fundamentals Residential part 1



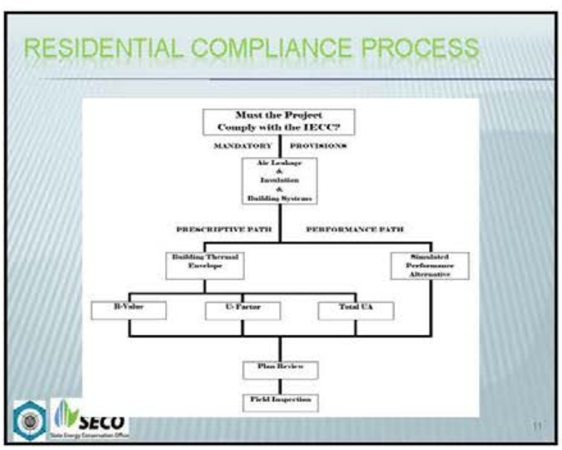
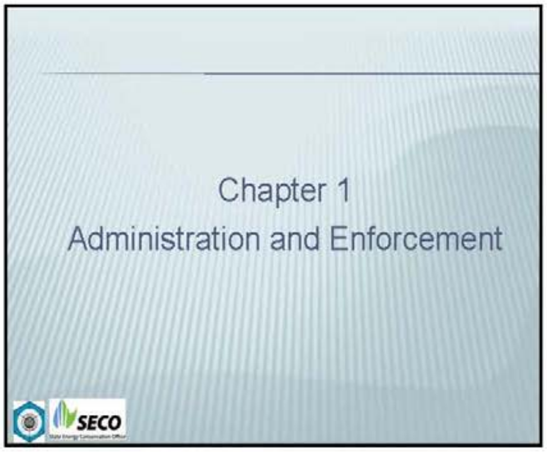
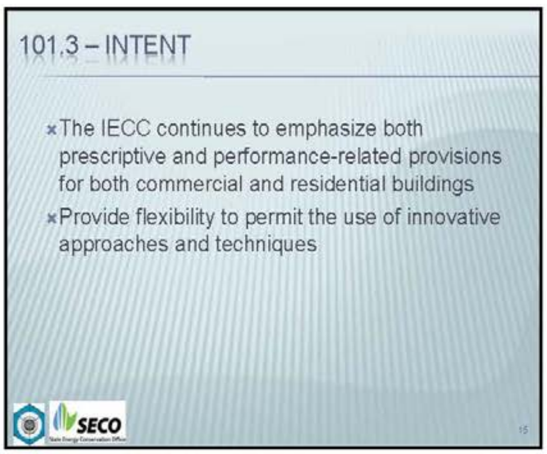


Figure 98: IECC Fundamentals Residential part 2





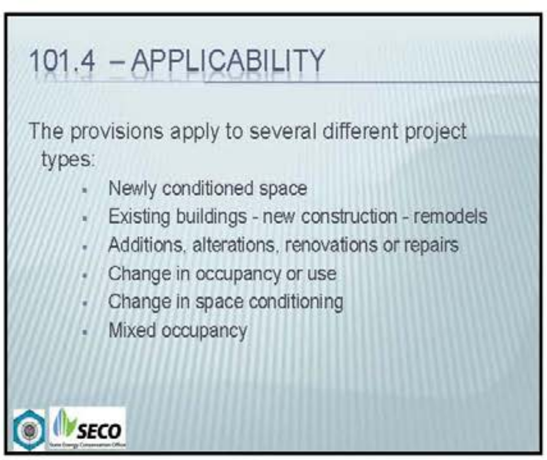
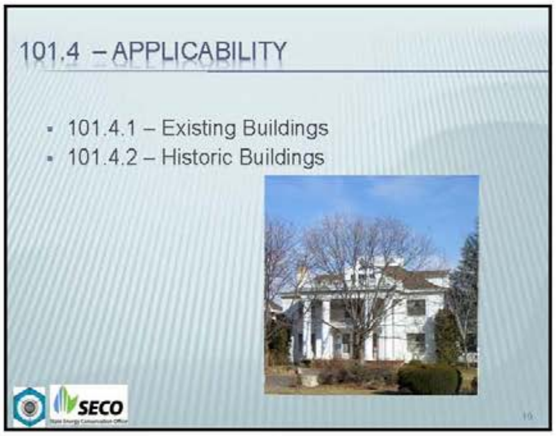
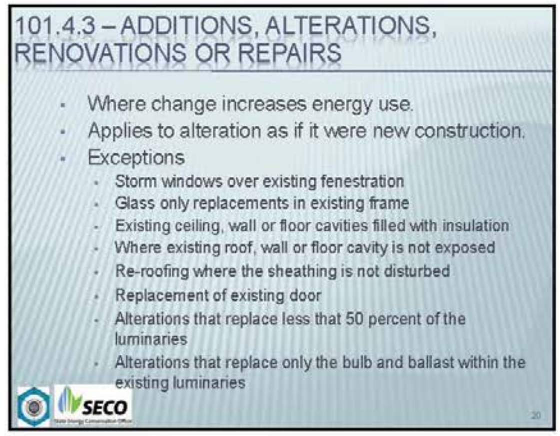
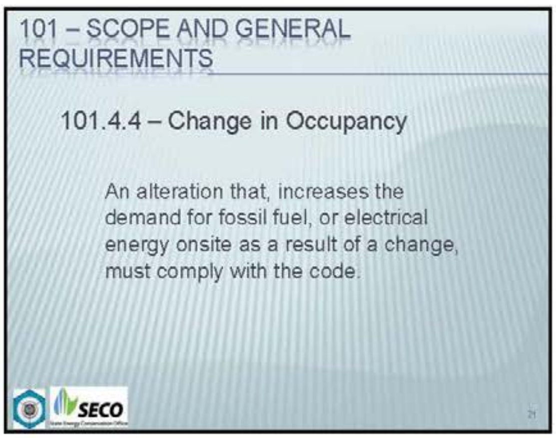


Figure 99: IECC Fundamentals Residential part 3







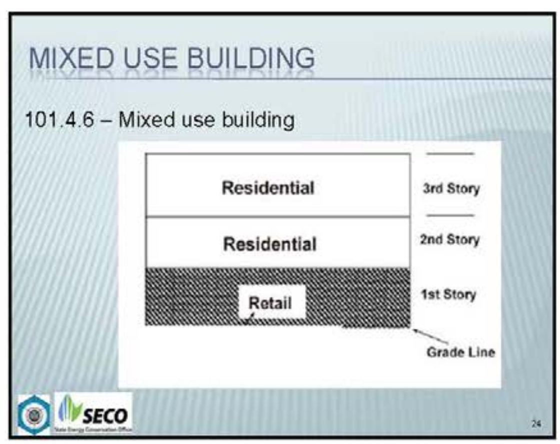
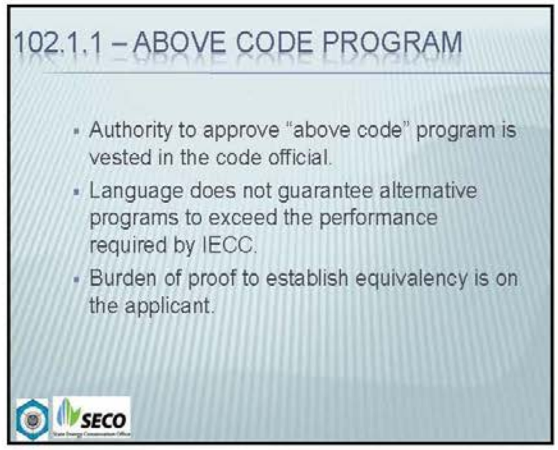
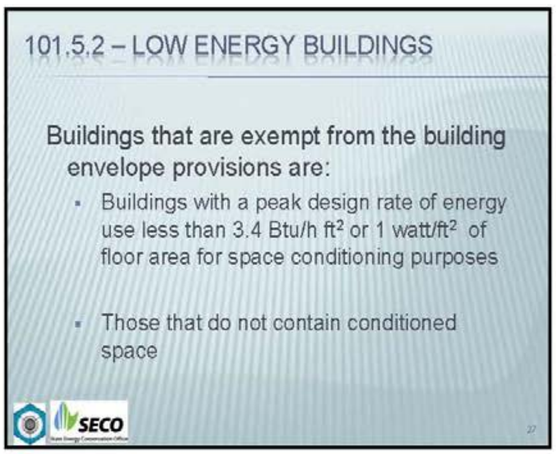
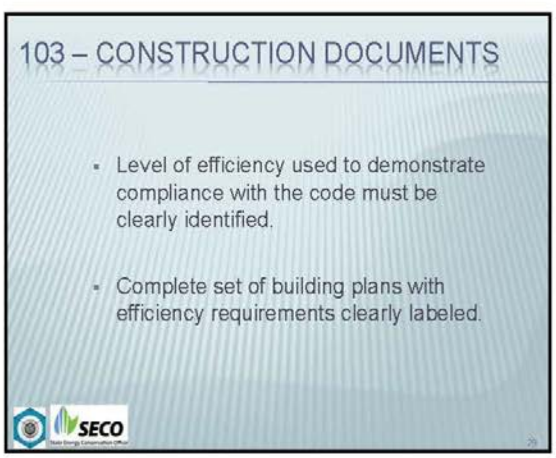


Figure 100: IECC Fundamentals Residential part 4







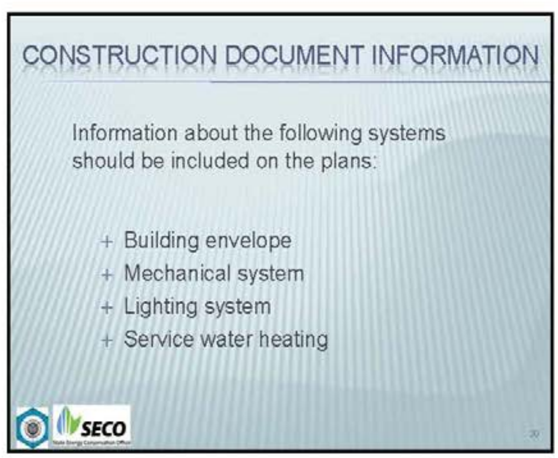
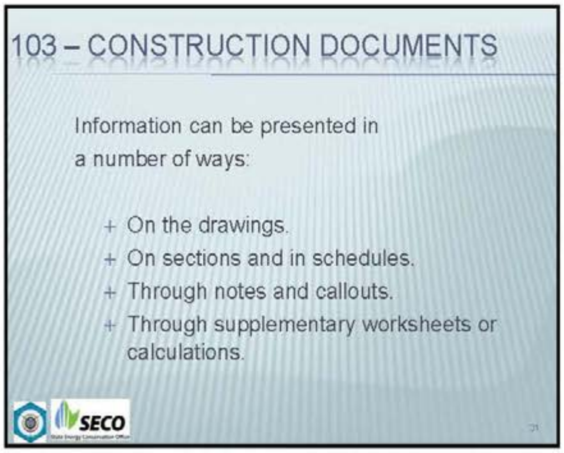
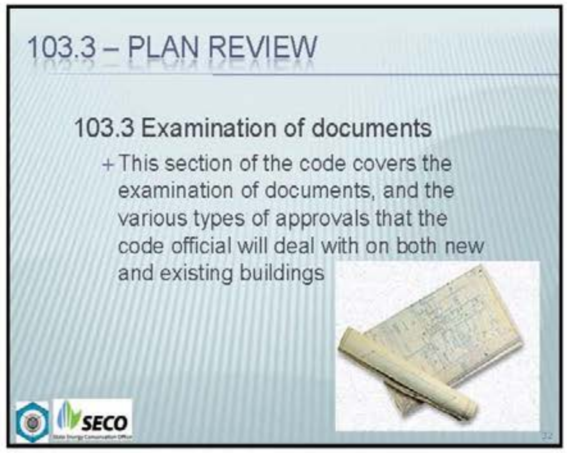
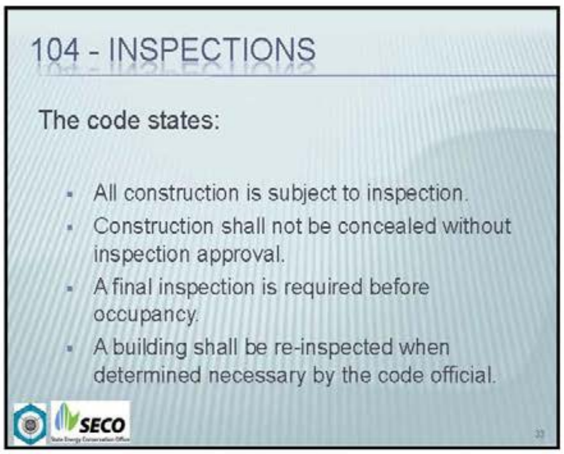
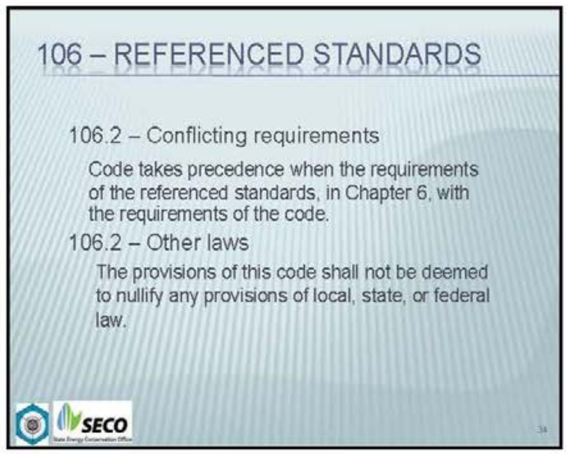


Figure 101: IECC Fundamentals Residential part 5









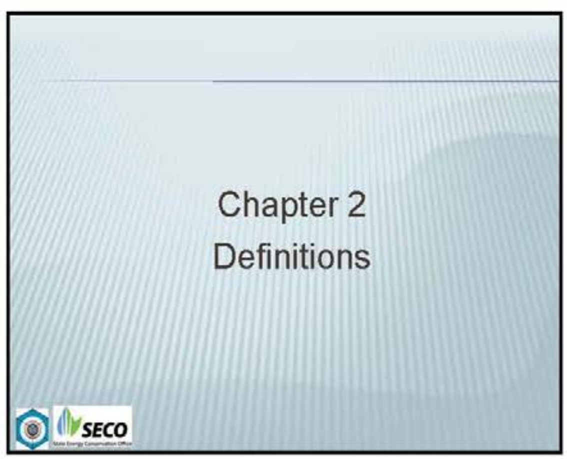
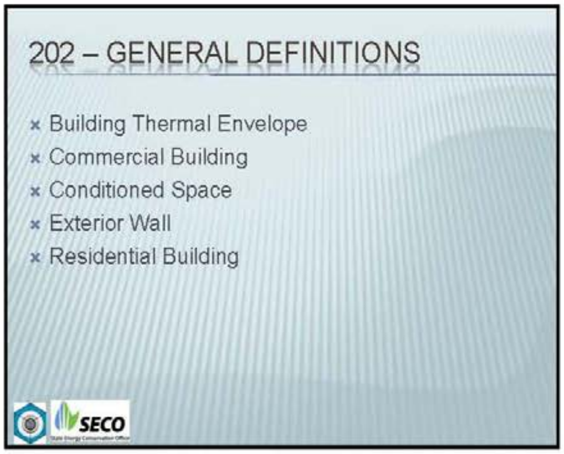
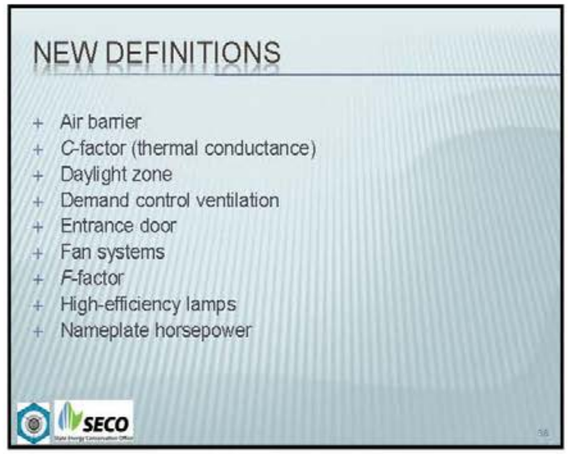
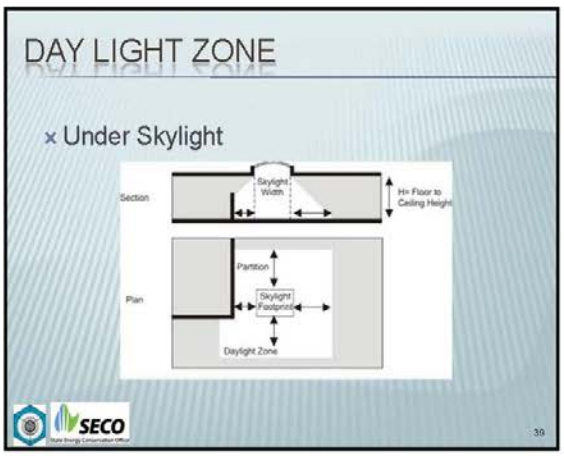
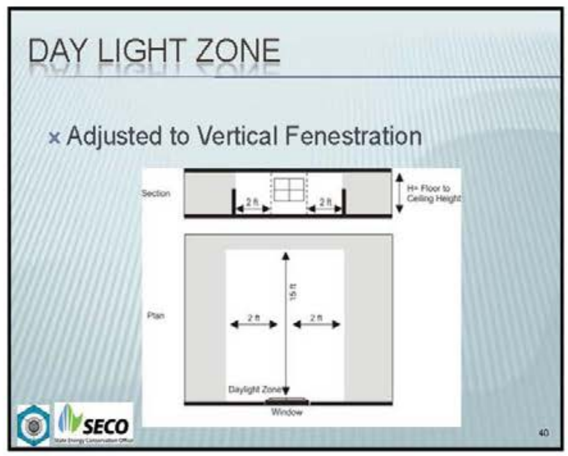


Figure 102: IECC Fundamentals Residential part 6









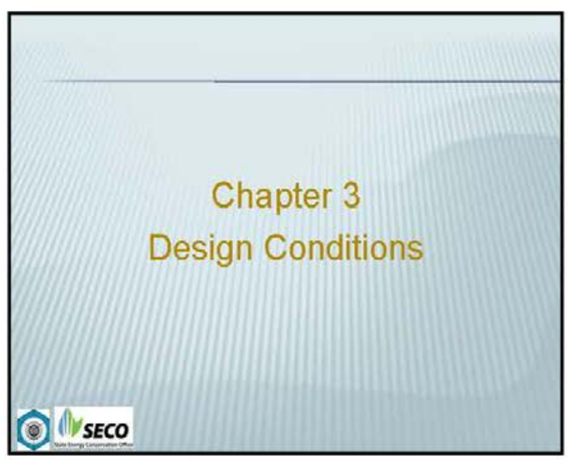
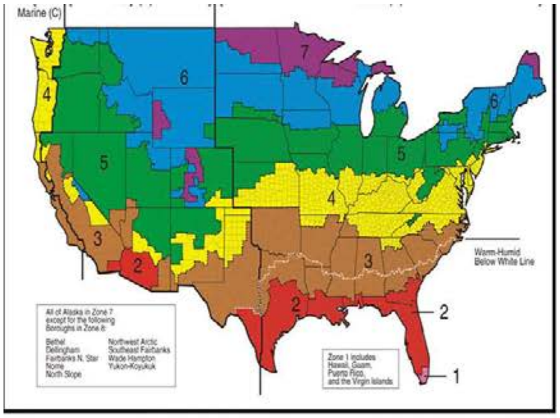
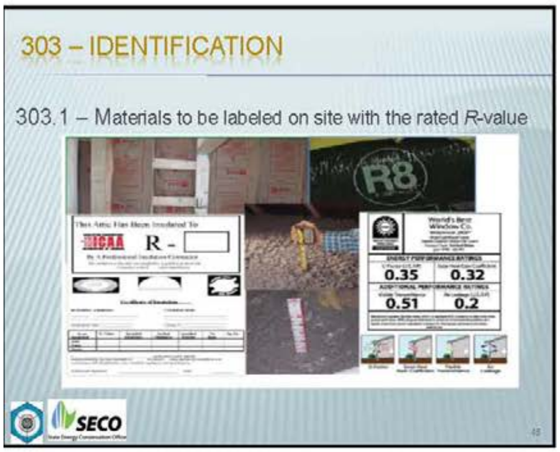


Figure 103: IECC Fundamentals Residential part 7





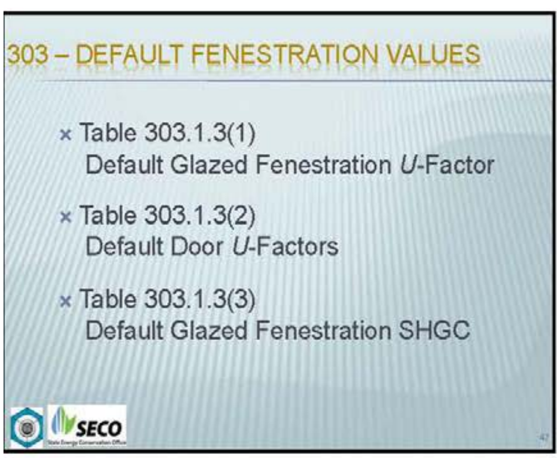


TABLE 302.1.3(1)
DEFAULT GLAZED FENESTRATION U-FACTOR

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT Single	SKYLIGHT Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

Figure 104: IECC Fundamentals Residential part 8

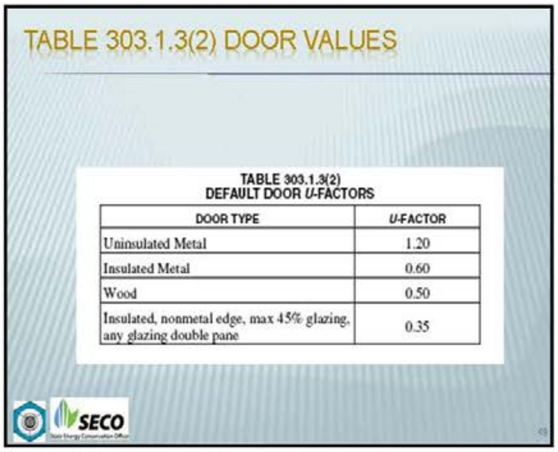


TABLE 303.1.3(2)
DEFAULT DOOR *U*-FACTORS

DOOR TYPE	*U*-FACTOR
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

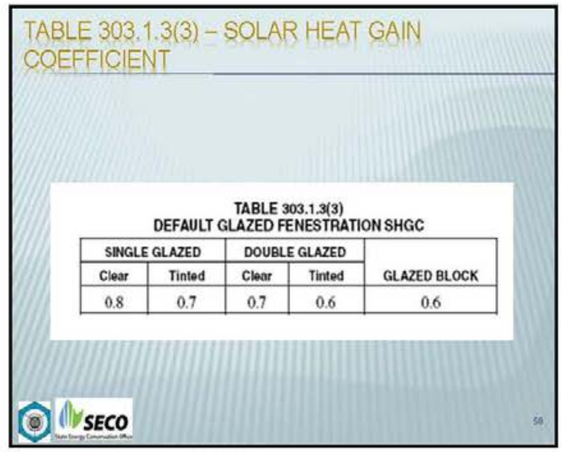
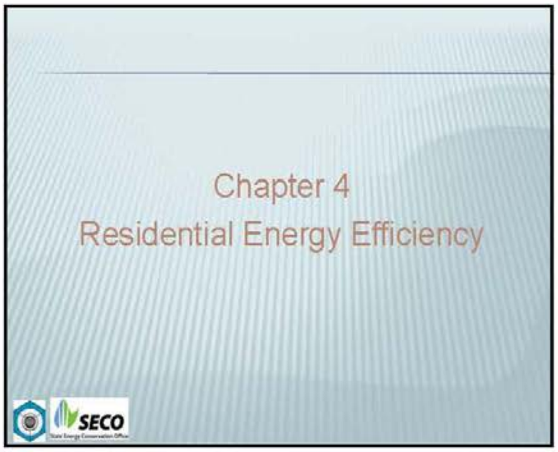
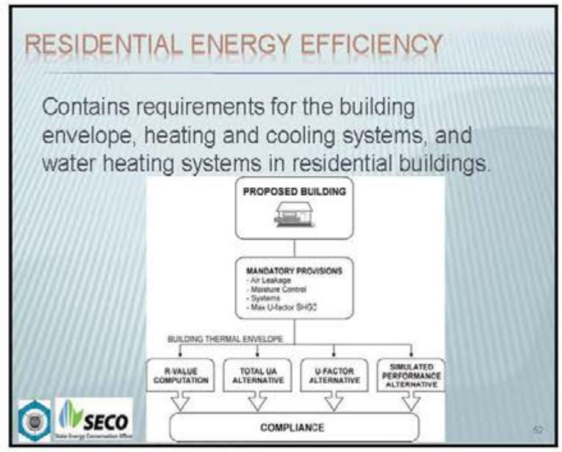
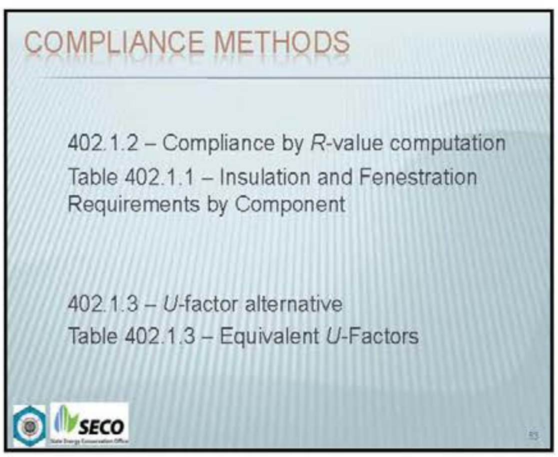


TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6







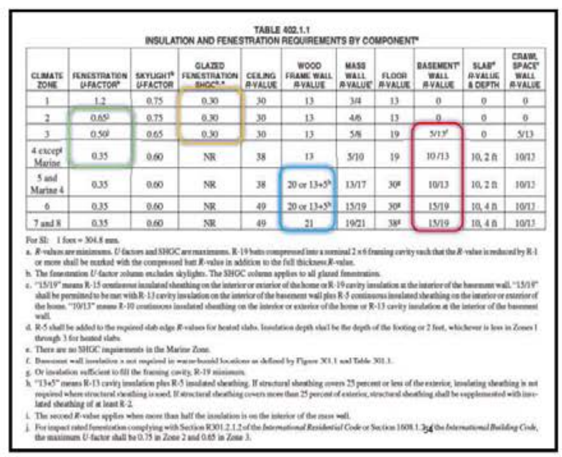


TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2 × 6 framing cavity such that the *R*-value is reduced by R-1 or more shall be marked with the compressed batt *R*-value in addition to the full thickness *R*-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

j. For impact rated fenestration complying with Section R301.2.1.2 of the *International Residential Code* or Section 1608.1.2 of the *International Building Code*, the maximum *U*-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

Figure 105: IECC Fundamentals Residential part 9

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR[d]	CRAWL SPACE WALL *U*-FACTOR[d]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, and the same as the frame wall *U*-factor in Marine Zone 4 and Zones 5 through 8.
c. Basement wall *U*-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.
d. Foundation *U*-factor requirements shown in Table 402.1.3 include wall construction and interior air films but exclude soil conductivity and exterior air films. *U*-factors for determining code compliance in accordance with Section 402.1.4 (total UA alternative) of Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air films.

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DETERMINING COMPLIANCE

An assembly *U*-factor must be calculated for each applicable assembly type proposed for the project.

The ASHRAE *Handbook of Fundamentals* is an excellent source of information on how to calculate an assembly *U*-factor.

SECO

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CALCULATING ASSEMBLY *U*-FACTORS

- The calculation must include the effects of framing.
- A *R*-value must be determined for each different material in the assembly.
- The *R*-values are then totaled to determine the total *R*-value through each thermal path of the assembly.
- The total *R*-values are then converted to *U*-factors by taking the reciprocal of the *R*-value.
- An area-weighted average *U*-factor is calculated for the wall system that takes into account the effects of framing.

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SAMPLE CALCULATION—WALLS

$$U_{ow} = \frac{(U_{w1} \times A_{w1}) + (U_{w2} \times A_{w2}) + \ldots}{A_{w1} + A_{w2} + \ldots}$$

Where

- U_{w1} = *U*-factor of opaque wall number 1
- A_{w1} = Area of opaque wall number 1
- U_{w2} = *U*-factor of opaque wall number 2
- A_{w2} = Area of opaque wall number 2

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402.1.4 – TOTAL UA ALTERNATIVE

- The building envelope design is permitted to deviate from *R*-values or *U*-factors in Tables 402.1.1 or 402.1.3, respectively, provided the total thermal transmittance (*UA*) is the same or less as the very same building envelope geometry designed to code

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402.2.1 – CEILINGS WITH ATTIC SPACES

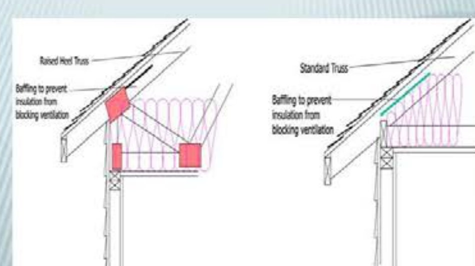

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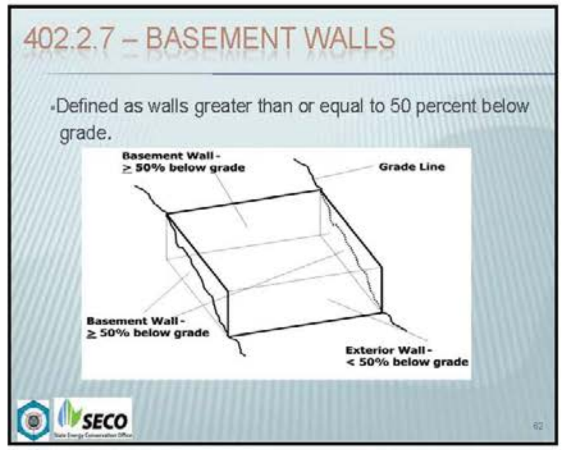
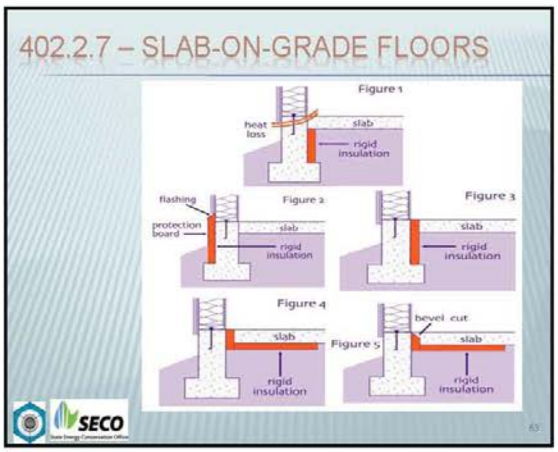
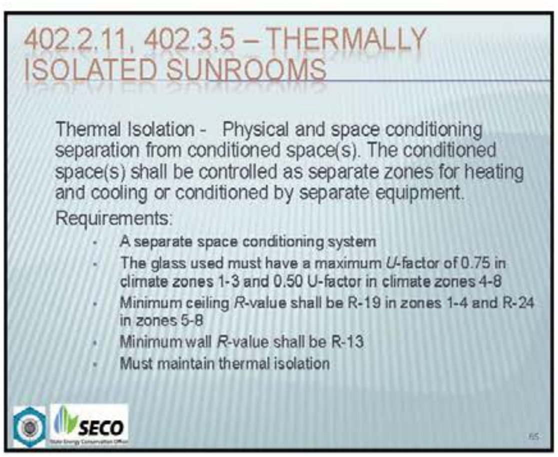
Figure 106: IECC Fundamentals Residential part 10







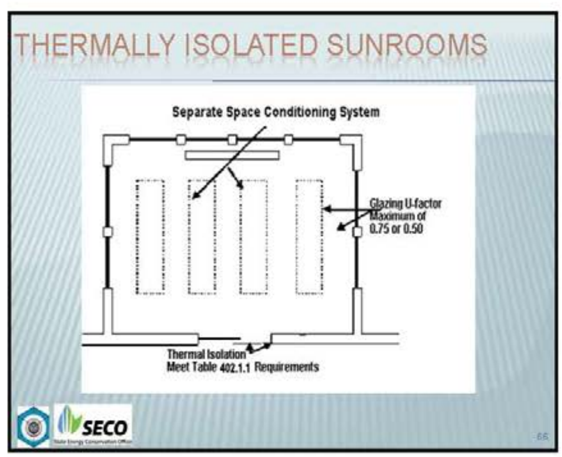
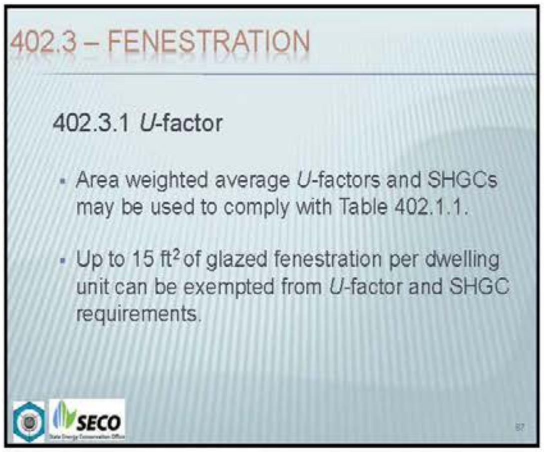
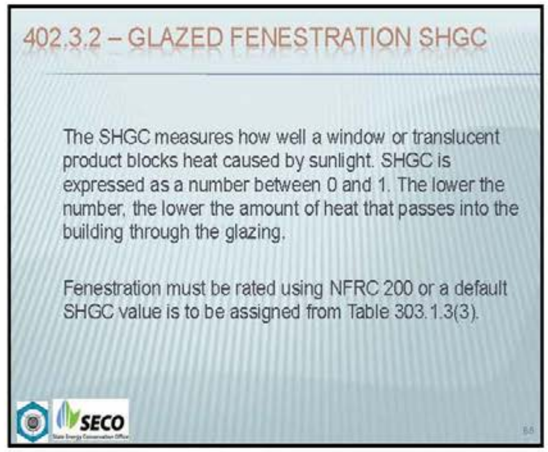
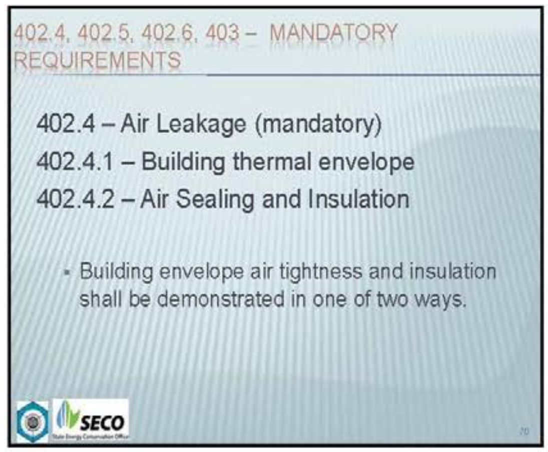
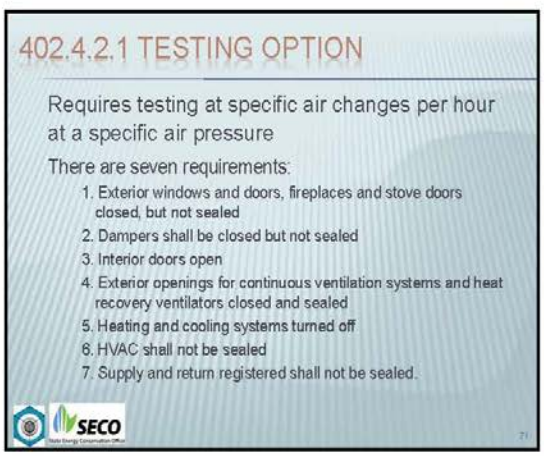


Figure 107: IECC Fundamentals Residential part 11









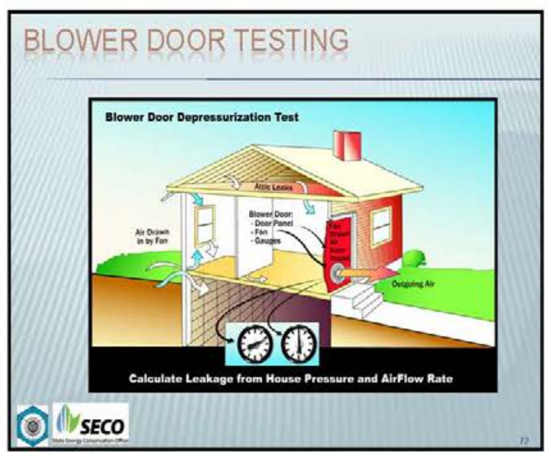
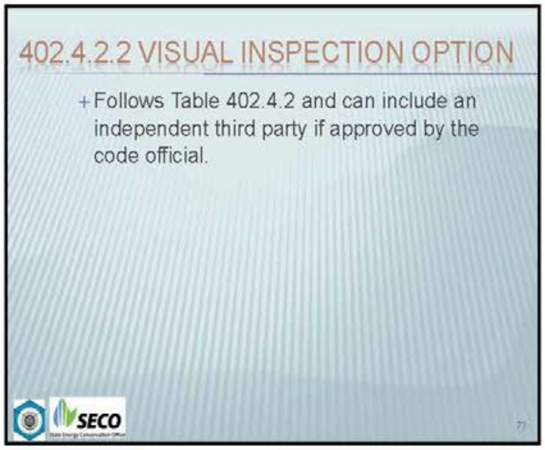
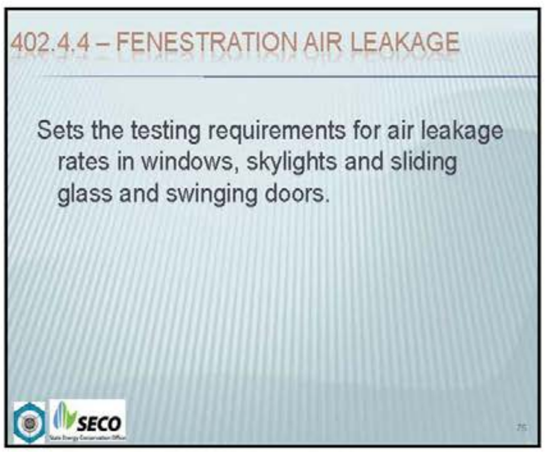
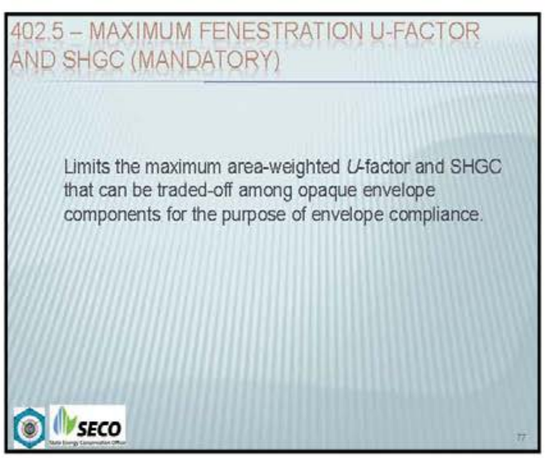


Figure 108: IECC Fundamentals Residential part 12







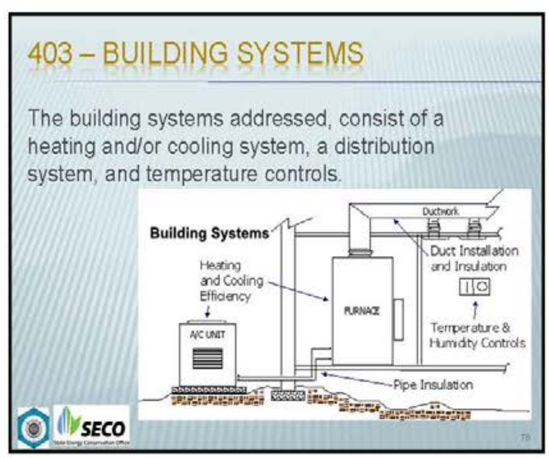
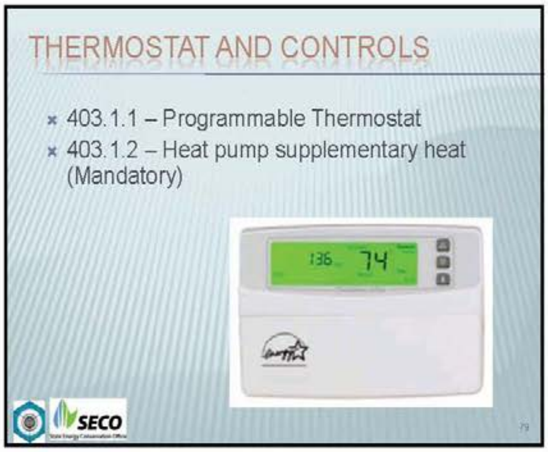
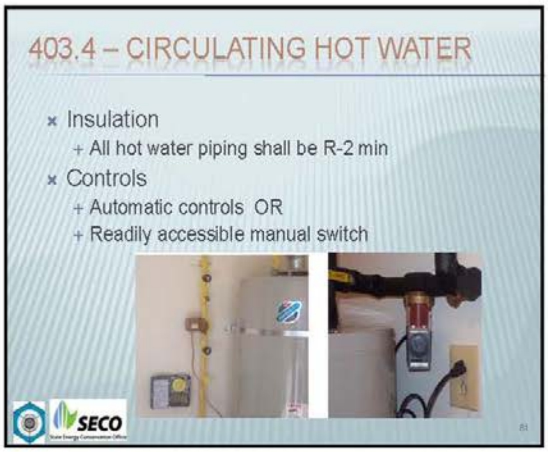
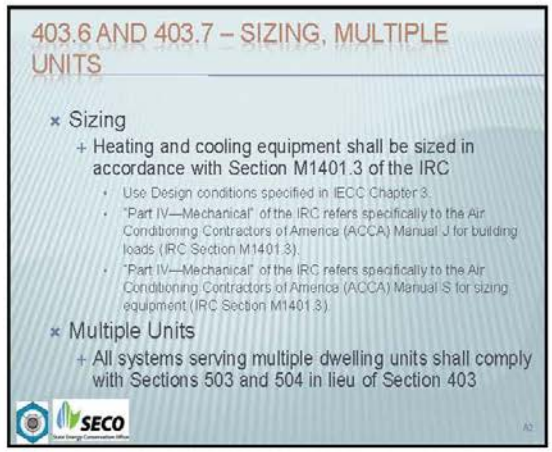
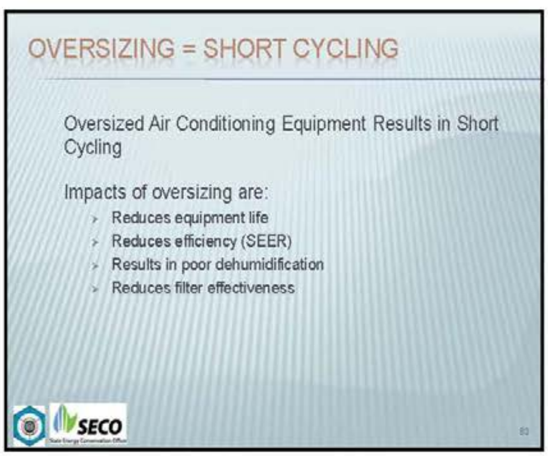


Figure 109: IECC Fundamentals Residential part 13









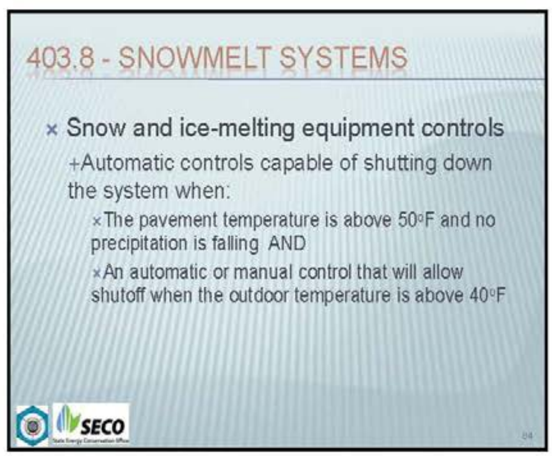
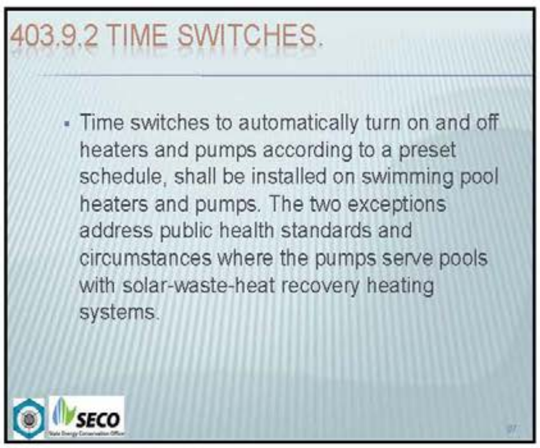
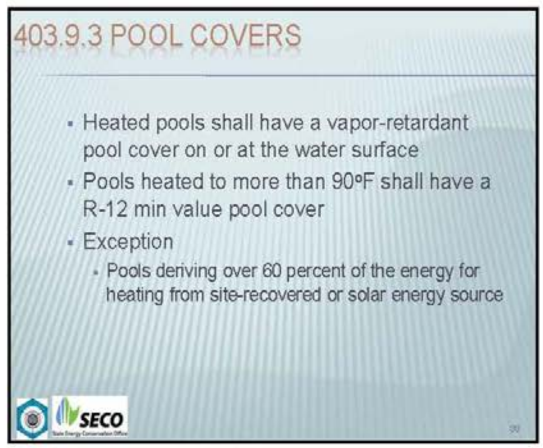


Figure 110: IECC Fundamentals Residential part 14





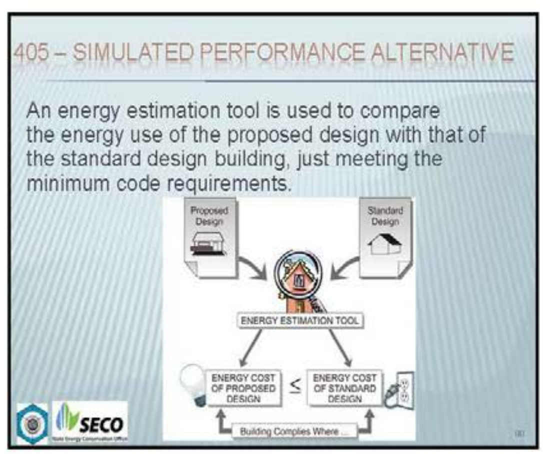
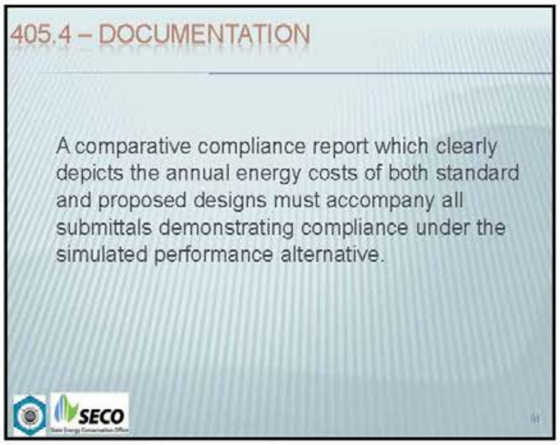
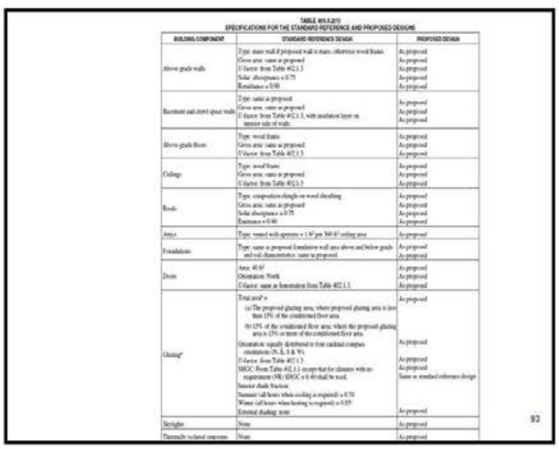
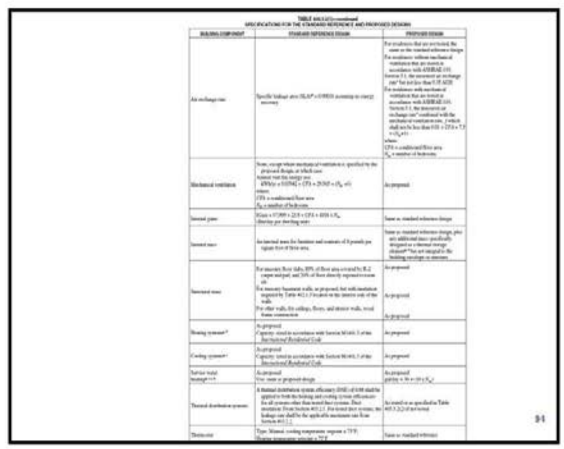


Figure 111: IECC Fundamentals Residential part 15







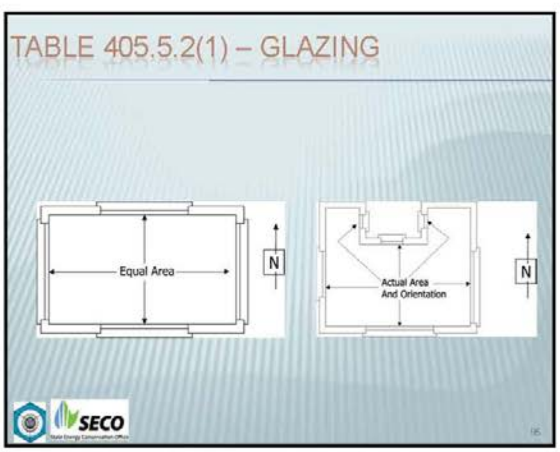


Figure 112: IECC Fundamentals Residential part 16

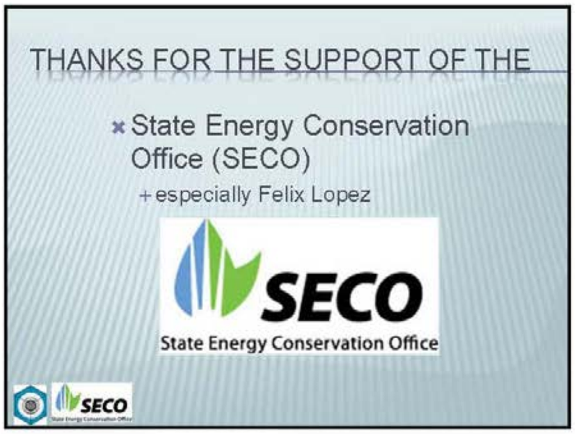


Figure 113: IECC Fundamentals Residential part 17

3.10 Evaluation of Additional Technologies for Reducing Energy Use in Existing Buildings

The Laboratory provided technical assistance to the TCEQ, the PUCT, SECO and ERCOT, as well as Stakeholders participating in the Energy Code and Renewables programs.

- In 2008, the Laboratory continued to work with the TCEQ to develop an integrated NOx emissions reductions calculation that provided the TCEQ with a creditable NOx emissions reductions from energy efficiency and renewable energy (EE/RE) programs reported to the TCEQ in 2008 by the Laboratory, PUCT, SECO, and ERCOT (i.e., wind).
- At the request of the TCEQ, the Laboratory has continued the development of procedures for quantifying NOx emissions reductions from wind turbines that includes weather normalization and the quantification of NOx emissions reductions from the new Federal regulations for SEER 13 air conditioners.

3.11 Planned Focus for 2011

In FY 2009, the Energy Systems Laboratory will continue in its cooperative efforts with the TCEQ, PUCT, SECO, US EPA and others to ensure EE/RE measures remain a cost-effective solution to clean air, and continue to support the energy efficiency and renewable energy opportunities of the TERP. The Laboratory team will:

- Assist the TCEQ to obtain SIP credits from energy efficiency and renewable energy using the Laboratory's Emissions Reduction Calculator technology;
- Verify, document and report energy efficiency and renewable energy savings in all TERP EE/RE programs for the SIP in each non-attainment and affected county using the TCEQ/US EPA approved technology;
- Assist the PUCT with determining emissions reductions credits from energy efficiency programs funded by SB 7 and SB 5;
- Assist political subdivisions and Councils of Governments with calculating emissions reductions from local code changes and voluntary EE/RE programs for SIP inclusion;
- Continue to refine the cost-effective techniques to implement 15% above code (2009 IECC) energy efficiency in low-priced and moderately-priced residential housing;
- Continue to refine the cost-effective methods and techniques to implement 15% above code energy efficiency in low-priced and moderately-priced commercial buildings;
- Continue to develop creditable procedures for calculating NOx emissions reductions from green renewable technologies, including wind power, solar energy and geothermal energy systems;
- Continue development of well-documented, integrated NOx emissions reductions methodologies for calculating and reporting NOx reductions, including a unified database framework for required reporting to TCEQ of potentially creditable measures from the ESL, PUCT, and SECO SB 5 initiatives;
- Upon request, provide written recommendations to the State Energy Conservation Office (SECO) about whether or not the energy efficiency provisions of latest published edition of the International Residential Code (IRC), or the International Energy Conservation Code (IECC), are equivalent to, or better than, the energy efficiency and air quality achievable under the editions adopted under the 2001 IRC/IECC. This will consider comments made by persons who have an interest in the adoption of the energy codes in the recommendations made to SECO.
- Develop a standardized report format to be used by providers of home energy ratings, including different report formats for rating newly constructed residences from those for existing residences.
- Continue to cooperate with an industry organization or trade association to: develop guidelines for home energy ratings; provide training for individuals performing home energy ratings and providers of home energy ratings; and provide a registry of completed ratings for newly constructed residences and residential improvement projects for the purpose of computing the energy savings and emissions reductions benefits of the home energy ratings program.
- Include all benefits attained from this program in an annual report to the commission.
- Enhance IC3 to support multifamily residences, and add other features to enhance adoption.
- Engage production builders and municipalities in overcoming obstacles to their using IC3 for their new home construction.
- Seek funding to enhance TCV (Austin's version of Ice).

- Replace ESL and TERP (SB5) websites with more accessible, easily navigable sites.

The Laboratory has and will continue to provide leading-edge technical assistance to counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering emissions and improving the air for all Texans. The Laboratory will continue to provide superior technology to the State of Texas through efforts with the TCEQ and US EPA. The efforts taken by the Laboratory have produced significant success in bringing EE/RE closer to US EPA acceptance in the SIP.

4 Introduction

4.1 Background

In 2001, the Texas Legislature adopted the Texas Emissions Reduction Plan, identifying thirty-eight counties in Texas where a focus on air quality improvements was deemed critical to public health and economic growth. These areas are shown on the map in Figure 26 as non-attainment and near nonattainment. In 2008, the twenty counties designated as nonattainment counties include: Brazoria, Chambers, Collin, Dallas, Denton, Ellis, Fort Bend, Hardin, Harris, Jefferson, Galveston, Johnson, Kaufman, Liberty, Montgomery, Orange, Parker, Rockwall, Tarrant, and Waller Counties. The fourteen counties designated as Ozone Early Action Compact counties include: Bastrop, Bexar, Caldwell, Comal, Gregg, Guadalupe, Harrison, Hays, Rusk, Smith, Travis, Upshur, Williamson, and Wilson County.

These counties represent several geographic areas of the state, which have been assigned to different climate zones by the 2001 IECC[14] as shown in Figure 27, based primarily on Heating Degree Days (HDD). These include climate zone 5 or 6 (i.e., 2,000 to 2,999 HDD_{65}) for the Dallas-Ft. Worth and El Paso areas, and climate zones 3 and 4 (i.e., 1,000 to 1,999 HDD_{65}) for the Houston-Galveston-Beaumont-Port Arthur-Brazoria areas. Also shown in Figure 27 are the locations of the various weather data sources, including the Typical Meteorological Year (TMY2) (NREL 1995) stations, the Weather Year for Energy Calculations (WYEC2) (Stoffel 1995) weather stations, the National Weather Service weather stations, (NWS) (NOAA 1993) weather stations, the ASHRAE 90.1 1989 weather locations[15], the ASHRAE 90.1 1999 weather locations, the solar stations measured by the National Renewable Energy Laboratory (NREL)[16], the solar stations measured by the TCEQ[17], and F-CHART and PV F-CHART weather locations[18].

[14] The "2000 IECC" notation is used to signify the 2000 International Residential Code (IRC), which includes the International Energy Conservation Code (IECC) as modified by the 2001 Supplement (IECC 2001), published by the ICC in March of 2001, as required by Senate Bill 5.

[15] The ASHRAE 90.1-1989 and 90.1-1999 weather stations are used in the emissions calculator for determining the building characteristics.

[16] The NREL stations were the primary source of the 1999 global horizontal, direct normal and diffuse solar radiation used to determine the 1999 peak-day and annual emissions for the DOE-2 simulations for code-compliant housing and commercial buildings.

[17] The TCEQ stations were used as the secondary source for global horizontal solar radiation when the NREL sites were missing data or no NREL site was nearby.

[18] The F-Chart and PV F-Chart weather locations are used to determine the solar thermal or electricity produced by the systems specified by the use in the emissions calculation. The monthly energy or electricity production from F-Chart or PV F-Chart is then weather-normalized using ASHRAE's Inverse Model Toolkit to develop coefficients that are then used to determine the 1999 annual and peak day energy or electricity production for emissions calculations.

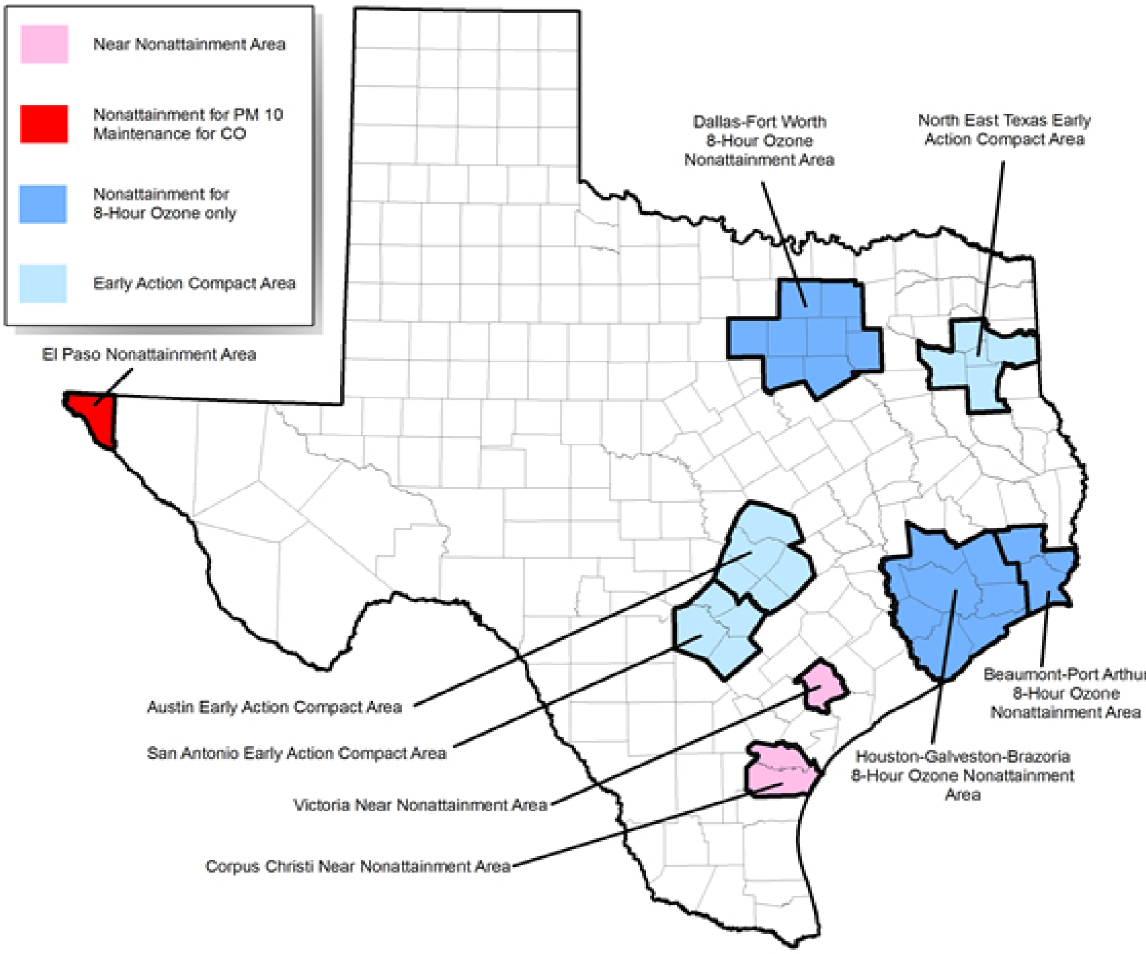


Figure 114: US EPA Nonattainment and Near Nonattainment

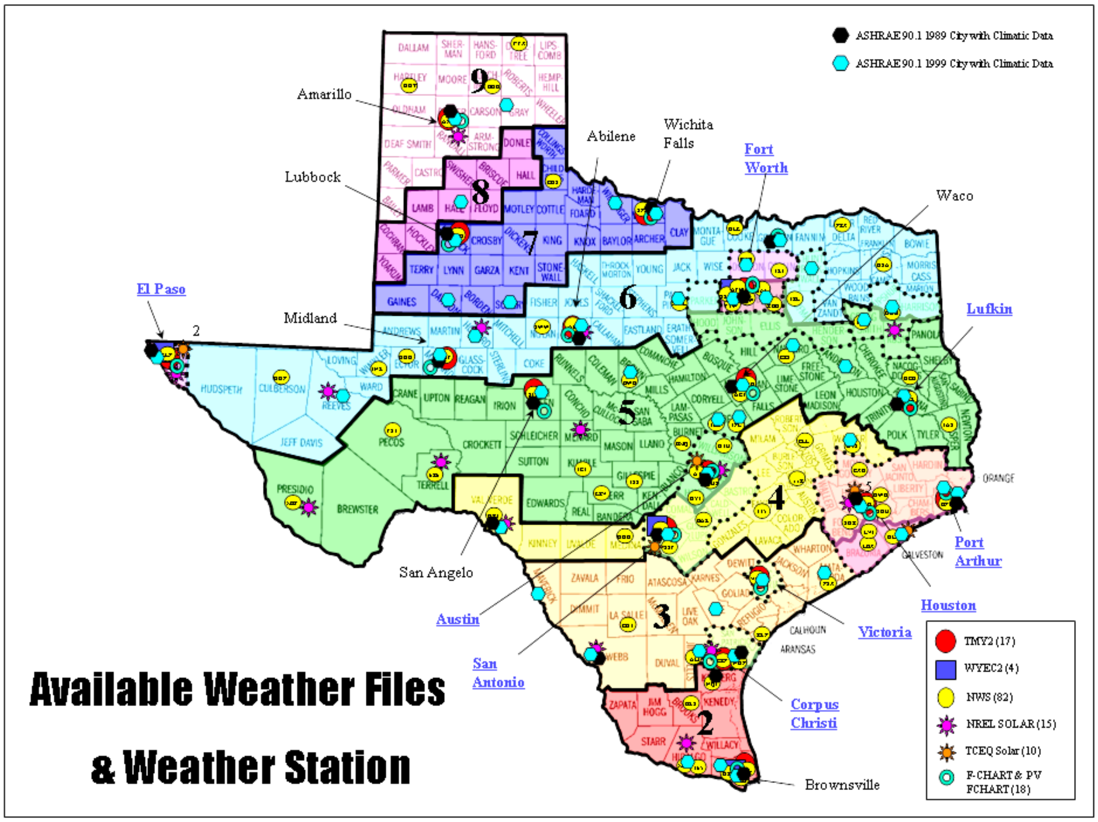
4.2 Energy Systems Laboratory's Responsibilities in the TERP

In 2001, Texas Senate Bill 5 outlined the following responsibilities for the Energy Systems Laboratory (ESL) within the TERP:

- Sec. 386.205. Evaluation of State Energy Efficiency Programs.
- Sec. 388.003. Adoption of Building Energy Efficiency Performance Standards.
- Sec. 388.004. Enforcement of Energy Standards Outside of Municipality.
- Sec. 388.007. Distribution of Information and Technical Assistance.
- Sec. 388.008. Development of Home Energy Ratings.

In 2003 these responsibilities were modified by the following:

- House Bill 1365, including modifications to:
  - Sec. 388.004. Enforcement of Energy Standards Outside of Municipality
  - Sec. 388.009. Energy-Efficient Building Program
- House Bill 3235 which includes modifications to
  - Sec. 388.009. Certification of Municipal Building Inspectors.



List of Available Weather Files and Weather Stations of Texas

Texas Weather Stations (NOAA)

1 Abilene Regional Airport (ABI)
2 Alice International Airport (ALI)
3 Amarillo International Airport (AMA)
4 Angleton / Lake Jackson Brazori (LBX)
5 Arlington Municipal Airport (GKY)
6 Austin - Bergstrom International (AUS)
7 Austin Camp Mabry (ATT)
8 Borger Hutchinson County Airport (BGD)
9 BRENHAM: BRENHAM MUNICIPAL AIRPORT (11R)
10 Brownsville S Padre Isl International (BRO)
11 BROWNWOOD: BROWNWOOD REGIONAL AIRPORT (BWD)
12 Burnet Municipal Airport (BMQ)
13 Childress Municipal Airport (CDS)
14 College Station (CLL)
15 Conroe Montgomery County Airport (CXO)
16 Corpus Christi International Airport (CRP)
17 CORPUS CHRISTI: CORPUS CHRISTI NAS/TRUAX FIELD ARPT (NGP)
18 Corsicana Campbell Field (CRS)
19 Cotulla La Salle Co Airport (COT)
20 Dalhart Municipal Airport (DHT)
21 Dallas - Fort Worth International Airport (DFW)
22 Dallas Love Field (DAL)
23 Dallas Redbird Airport (RBD)
24 Del Rio International Airport (DRT)
25 Denton Municipal Airport (DTO)
26 Dryden Terrell County Airport (6R6)
27 El Paso International Airport (ELP)
28 FALFURRIAS: BROOKS COUNTY AIRPORT (BKS)
29 Fort Stockton Pecos County Airport (FST)
30 Fort Worth Alliance Airport (AFW)
31 Fort Worth Meacham (FTW)
32 FREDERICKSBURG: GILLESPIE COUNTY AIRPORT (T82)
33 GAINESVILLE: GAINESVILLE MUNICIPAL AIRPORT (GLE)
34 Galveston Scholes Field (GLS)
35 GEORGETOWN: GEORGETOWN MUNICIPAL AIRPORT (GTU)
36 Harlingen Rio Grande Valley I (HRL)
37 Hondo Municipal Airport (HDO)
38 Houston Bush Intercontinental (IAH)
39 Houston Clover Field (LVJ)
40 Houston Hooks Memorial Airport (DWH)
41 Houston Sugarland Mem (SGR)
42 Houston William P Hobby Airport (HOU)
43 Huntsville Municipal Airport (UTS)
44 JASPER: JASPER COUNTY-BELL FIELD AIRPORT (JAS)
45 Junction Kimble County Airport (JCT)
46 KERRVILLE: KERRVILLE MUNI/LOUIS SCHREINER FLD AIRPORT (ERV)
47 KILLEEN: KILLEEN MUNICIPAL AIRPORT (ILE)
48 KINGSVILLE: KINGSVILLE NAS AIRPORT (NQI)
49 LA GRANGE: FAYETTE REGIONAL AIR CENTER AIRPORT (3T5)
50 Longview E Tx Rgnl Airport (GGG)
51 Lubbock International Airport (LBB)
52 Lufkin Angelina Cty Airport (LFK)
53 MARFA: MARFA MUNICIPAL AIRPORT (MRF)
54 McAllen Miller International Airport (MFE)
55 McKinney Municipal Airport (TKI)
56 Midland International Airport (MAF)
57 Mineral Wells Airport (MWL)
58 MOUNT PLEASANT: MOUNT PLEASANT REGIONAL AIRPORT (OSA)
59 NACOGDOCHES: A L MANGHAM JR REGIONAL AIRPORT (OCH)
60 New Braunfels Municipal Airport (BAZ)
61 Odessa Schlemeyer Field (ODO)
62 Palacios Municipal Airport (PSX)
63 PARIS: COX FIELD AIRPORT (PRX)
64 PERRYTON: PERRYTON OCHILTREE COUNTY AIRPORT (PYX)
65 Pine Springs Guadalupe Mounta (GDP)
66 Port Arthur Se Tx Rgnl Airport (BPT)
67 Port Isabel Cameron County Airport (PIL)
68 Rockport Aransas Co Airport (RKP)
69 San Angelo Mathis Field (SJT)
70 San Antonio International Airport (SAT)
71 San Antonio Stinson Municipal Airport (SSF)
72 SAN MARCOS: SAN MARCOS MUNICIPAL AIRPORT (HYI)
73 SWEETWATER: AVENGER FIELD AIRPORT (SWW)
74 TEMPLE: DRAUGHON-MILLER CNTRL TEXAS REGIONAL ARPT (TPL)
75 Terrell Municipal Airport (TRL)
76 Tyler Pounds Field (TYR)
77 Victoria Regional Airport (VCT)
78 WACO: MC GREGOR EXECUTIVE AIRPORT (PWG)
79 Waco Regional Airport (ACT)
80 WESLACO: MID VALLEY AIRPORT (T65)
81 Wichita Falls Municipal Airport (SPS)
82 Wink Winkler Co Airport (INK)

Texas TMY2 Weather Files

1 Abilene
2 Amarillo
3 Austin
4 Brownsville
5 Corpus Christi
6 El Paso
7 Fort Worth
8 Houston
9 Lubbock
10 Lufkin
11 Midland
12 Port Arthur
13 San Angelo
14 San Antonio
15 Victoria
16 Waco
17 Wichita Falls

Texas WYEC2 Weather Files

1 El Paso
2 Brownsville
3 Fort Worth
4 San Antonio

NREL Solar Stations

1 Abilene
2 Austin
3 Big Spring
4 Canyon
5 Clear Lake
6 Corpus Christi
7 Del Rio
8 Edinburg
9 El Paso
10 Laredo
11 Menard
12 Overton
13 Pecos
14 Presidio
15 Sanderson

TCEQ Solar Stations

1 Bexar
2 Travis
3 El Paso (2)
4 Galveston
5 Harris (5)

FCHART and PV FCHART (New Weather File)

1 ABILENE
2 AMARILLO
3 AUSTIN
4 BROWNSVILLE
5 CORPUS CHRISTI
6 EL PASO
7 FORT WORTH
8 HOUSTON
9 LUBBOCK
10 LUFKIN
11 MIDLAND-ODESSA
12 PORT ARTHUR
13 SAN ANGELO
14 SAN ANTONIO
15 SHERMAN
16 VICTORIA
17 WACO
18 WICHITA FALLS

Figure 115: Available NWS, TMY2 and WYEC2 weather files compared to IECC/IRC weather zones for Texas

In 2005 these same responsibilities were further updated by

- with Senate Bill 20, House Bill 2481, and 2129.

These responsibilities were further updated in 2007:

- with Senate Bill 12 and House Bill 3693.

These responsibilities were further updated in 2007:

- with Senate Bill 12 and House Bill 3693.

In the following sections each of these tasks is further described.

4.2.1 (SB 5) Section 386.205. Evaluation of State Energy Efficiency Programs (w/PUCT)

The Laboratory is instructed to assist the Public Utility Commission of Texas (PUCT) and provide an annual report that quantifies by county the reductions of energy demand, peak loads, and associated emissions of air contaminants achieved from the programs implemented under this subchapter and from those implemented under Section 39.905, Utilities Code (i.e., Senate Bill 7).

4.2.2 (SB 5) Sec. 388.003. Adoption of Building Energy Efficiency Performance Standards.

TERP adopts the energy efficiency chapter of the 2001 International Residential Code (2001 IRC) as an energy code for single-family residential construction, and the 2001 International Energy Conservation Code (2001 IECC) for all other residential, commercial and industrial construction in the state. It requires that municipalities establish procedures for administration and enforcement, and ensure that code-certified inspectors perform inspections.

TERP provides that local amendments, in non-attainment areas and affected counties, may not result in less stringent energy efficiency requirements. The Laboratory is to review local amendments, if requested, and submit an annual report of savings impacts to the TCEQ. The Laboratory is also authorized to collect fees for certain of its tasks in Sections 388.004, 388.007 and 388.008.

4.2.3 (SB 5) Sec. 388.004. Enforcement of Energy Standards Outside of Municipality

For construction outside of the local jurisdiction of a municipality, TERP provides for a building to comply if:

a) a building certified by a national, state, or local accredited energy efficiency program shall be considered in compliance;
b) a building with inspections from private code-certified inspectors using the energy efficiency chapter of the International Residential Code or International Energy Conservation Code shall be considered in compliance; and
c) a builder who does not have access to either of the above methods for a building shall certify compliance using a form provided by the Laboratory, enumerating the code-compliance features of the building.

4.2.4 (SB 5) Sec. 388.007. Distribution of Information and Technical Assistance

The Laboratory is required to make available to builders, designers, engineers, and architects code implementation materials that explain the requirements of the International Energy Conservation Code and the energy efficiency chapter of the International Residential Code. TERP authorizes the Laboratory to develop simplified materials to be designed for projects in which a design professional is not involved. It also authorizes the Laboratory to provide local jurisdictions with technical assistance concerning implementation and enforcement of the International Energy Conservation Code and the energy efficiency chapter of the International Residential Code.

4.2.5 (SB 5) Sec. 388.008. Development of Home Energy Ratings.

TERP requires the Laboratory to develop a standardized report format to be used by providers of home energy ratings (HERs). The form must be designed to give potential buyers information on a structure's energy performance, including certain equipment. TERP requires the Laboratory to establish a public information program to inform homeowners, sellers, buyers, and others regarding home energy ratings.

4.2.6 (HB 1365) Sec. 388.004. Enforcement of Energy Standards Outside of Municipality

In 2003, House Bill 1365 modified Section 388.004 of The TERP to include the following new requirements:

- That builders shall retain for three years documentation which shows their building is in compliance with the Texas Building Energy Performance Standards, and that builders shall provide a copy of the compliance documentation to homeowners.
- That single-family residences built in unincorporated areas of counties, which were completed on or after September 1, 2001, but not later than August 31, 2003, are considered in compliance with the Texas Building Energy Performance Standards.

To help builders comply with these requirements, the Laboratory will enhance the current form, which is posted on the Laboratory's The TERP website.

4.2.7 (HB 1365) Sec. 388.009. Energy-Efficient Building Program

In 2003, House Bill 1365 modified the TERP, adding a new Section 388.009. In this section the General Land Office, the TCEQ and the Laboratory, working with an advisory committee, may develop an energy-efficient building accreditation program for buildings that exceed the building energy performance standards under Section 388.003 by 15% or more. This program shall be updated annually to include best available energy-efficient building practices. This program shall use a checklist system to produce an energy-efficient building scorecard to help: (1) home buyers compare potential homes and, by providing a copy of the completed scorecard to a mortgage lender, qualify for energy-efficient mortgages under the National Housing Act; and (2) communities qualify for emissions reduction credits by adopting codes that meet or exceed the energy-efficient building or energy performance standards established under this chapter. This effort may include a public information program to inform homeowners, sellers, buyers, and others regarding energy-efficient building ratings. The Laboratory shall establish a system to measure the reduction in energy and emissions produced under the energy-efficient building program and report those savings to the commission.

4.2.8 (HB 3235) Sec. 388.009. Certification of Municipal Inspectors

Also in 2003, House Bill 3235 modified the TERP to add the new Section 388.009. In this section the Laboratory is required to develop and administer a state-wide training program for municipal building inspectors who seek to become code-certified inspectors. To accomplish this, the Laboratory will work with national code organizations to assist participants in the certification program and is allowed to collect a reasonable fee from participants in the program to pay for the costs of administering the program. This program is required to be developed no later than January 1, 2004, with state-wide training sessions starting no later than March 1, 2004.

4.2.9 (SB 20, HB 2481, HB 2129). Additional Energy-Efficiency Initiatives

The 79th Legislature, through SB 20, HB 2481 and HB 2129, amended SB 5 to enhance its effectiveness by adding the following additional energy-efficiency initiatives, including requiring 5,880 MW of generating capacity from renewable energy technologies by 2015, and 500 MW from non-wind renewables.

This legislation also requires PUCT to establish a target of 10,000 MW of installed renewable capacity by 2025, and requires TCEQ to develop a methodology for computing emissions reductions from renewable energy initiatives and the associated credits. The Laboratory is to assist TCEQ in quantifying emissions reductions credits from energy-efficiency and renewable-energy programs, through a contract with the Texas Environmental Research Consortium (TERC) to develop and annually calculate creditable emissions reductions from wind and other renewable energy resources for the state's SIP.

Finally, this legislation requires the Laboratory to develop at least 3 alternative methods for achieving a 15% greater potential energy savings in residential, commercial and industrial construction. To accomplish this, the Laboratory will be using the code-compliance calculator to ascertain which measures are best suited for reducing energy use without requiring substantial investments.

4.2.10 (SB 12, HB 3693). Additional Energy-Efficiency Initiatives

The 80th Legislature (2007), through SB 12, and HB 3693 amended SB 5 to enhance its effectiveness by adding several new energy efficiency initiatives. First, it requires the Laboratory to provide written recommendations to the State Energy Conservation Office (SECO) about whether or not the energy efficiency provisions of latest published edition of the International Residential Code (IRC), or the International Energy Conservation Code (IECC), are equivalent to or better than the energy efficiency and air quality achievable under the editions adopted under the 2001 IRC/IECC. The laboratory shall make its recommendations not later than six months after publication of new editions at the end of each three-year code development cycle of the International Residential Code and the International Energy Conservation Code. As part of this work with SECO, the Laboratory is required to consider comments made by persons who have an interest in the adoption of the energy codes in the recommendations made to SECO.

In addition, it requires the Laboratory to develop a standardized report format to be used by providers of home energy ratings, including different report formats for rating newly constructed residences from those for existing residences. The form must be designed to give potential buyers information on a structure's energy performance, including: insulation; types of windows; heating and cooling equipment; water heating equipment; additional energy conserving features, if any; results of performance measurements of building tightness and forced air distribution; and an overall rating of probable energy efficiency relative to the minimum requirements of the International Energy Conservation Code or the energy efficiency chapter of the International Residential Code, as appropriate.

It also encourages the Laboratory to cooperate with an industry organization or trade association to: develop guidelines for home energy ratings; provide training for individuals performing home energy ratings and providers of home energy ratings; and provide a registry of completed ratings for newly constructed residences and residential improvement projects for the purpose of computing the energy savings and emissions reductions benefits of the home energy ratings program. Finally, it requires the Laboratory shall to include information on the benefits attained from this program in an annual report to the commission.

5 Progress: January 2010 through December 2010

5.1 (SB 5) Section 386.205. Evaluation of State Energy-Efficiency Programs (w/PUCT)

5.1.1 Implemented Procedures for Evaluating State Energy-Efficiency Programs

In 2004 the Laboratory held several meetings with the Public Utility Commission of Texas to discuss the development of a framework for reporting emissions reduction from the State Energy Efficiency Programs administered by the PUCT. The State Energy-Efficiency Programs administered by the PUCT include programs under Senate Bill 7 (i.e., Section 39.905 Utilities Code) and Senate Bill 5.

In 2003 and 2004, the Laboratory worked with the TCEQ to identify a method to help the PUCT more accurately report their deemed savings as peak-day savings in 1999, using the Laboratory's new emissions reductions calculator. In 2005, this method was implemented in the TCEQ's Integrated Emissions Calculations, which was reported in the 2005, 2006, 2007, 2008 and 2009 annual report.

5.2 (SB 5) Sec. 388.003. Adoption of Building Energy-Efficiency Performance Standards

5.2.1 Provide Code Training Sessions

During the 77th Legislature, Senate Bill 5 (SB 5) adopted the 2000 International Residential Code (IRC) as the energy code for single-family residential construction and the 2000 edition of the International Energy Conservation Code (IECC), with the 2001 Supplement for all other residential, commercial and industrial construction in the state. It requires that municipalities establish procedures for administration and enforcement, and ensure that code-certified inspectors perform inspections.

These codes are published by the International Code Council (ICC), which publishes a new edition every three years and a supplement in the intervening years. The 2003 Codes have been reviewed and determined to be no less stringent than the editions currently adopted by SB 5. Transition to the 2003 IRC and IECC can be easily accomplished. The 2006 Codes were reviewed and the residential provisions were determined to be less stringent than the editions adopted by SB 5 while the commercial provisions were determined to be as stringent as those in SB 5. Energy System Laboratory has assisted the local legislative bodies with amendments to the residential portions of the 2006 International Energy Conservation Code to insure it remains in compliance with the State Regulations concerning stringency.

Section 388.009 requires the Laboratory to develop and administer a state-wide training program for municipal building inspectors who seek to become code-certified inspectors. To accomplish this, the Laboratory developed the Energy Code Workshops which are based on the 2003 and 2006 International Energy Conservation Code (IECC) as published by the International Code Council (ICC) for residential and commercial buildings, with amendments. In addition, three more workshops were developed that offered software training, ASHRAE Standard 62.1 and ASHRAE Standard 90.1.

The Residential Energy Code Training Workshop and Commercial Requirements of the International Energy Conservation Workshop both include an overview of the TERP program and extensive instruction on all chapters of the IECC, which include the general requirements, definitions, and design conditions. The 2003 and 2006 Residential Workshops also includes detailed instruction on Chapter(s) which contain specific regulations relating to residential construction, in addition to a comparison of the IECC and the energy provisions of the International Residential Code (IRC). The 2003 and 2006 Commercial Workshops includes detailed instruction on Chapter(s), which relate to commercial regulations and a summary of the relationship between ASHRAE 90.1 and the commercial provisions of the IECC.

In 2010 the TERP group prepared for the trainings that were to be offered in 2012.

- January 21-25: Gathering of 90.1 updated materials from the ASHRAE 90.1 Standards committee meetings in Chicago, Illinois. These were organized into workshop presentation materials for workshops offered in 2011.

- June 23-27: Participation in the ASHRAE 90.1 Standards committee meetings in San Antonio, Texas, to obtain critical updates for the offering of 90.1 training workshops, which came later in 2011.

5.2.2 Summary of ASHRAE Standard 90.1 Standards Committee Activities during 2010, and Ongoing Subcommittee Actions

The following paragraphs track the changes and discussion in the ASHRAE 90.1 code at the ASHRAE winter conference in Orlando, Florida and ASHRAE summer conference in Albuquerque, New Mexico. Both the conferences took place in 2010.

Overall there have been 109 approved addenda to the 90.1-2007 which is incorporated in 90.1-2010 Standard of which 41 addenda provide energy savings. Approved addenda for the envelope include provisions for high albedo roofs, updated criteria for metal buildings, opaque and fenestration envelope requirements, projection factor adjustment to SHGC and vestibule requirements, introduction of air leakage requirements. Approved addenda for mechanical systems include VAV fan requirements for large single zone units, alternate compliance path for water-cooled chillers with high part load efficiency (VFD), ventilation rates based on ASHRAE 62.1-2004, demand control ventilation requirements, updated heat recovery specifications, cooling tower efficiencies, updating maximum flow rates for chilled and condenser water piping, resetting supply air temperatures, modifications to kitchen hood specifications, updates to economizer specifications, and fan power limitations. Approved addenda for the lighting section includes lighting control credits for automatic lighting controls, automatic lighting shutoff in guest room bathrooms and four-zone lighting power density approach for exterior lighting requirements. Other approved addenda which would be added to the 2007 ASHRAE 90.1 code include making Appendix-G normative, requirements for low-voltage dry-type transformers and heat pump pool water heater requirements. Some of these addenda are discussed in the 2009 annual report and will not be included in the discussion below.

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5.2.2.1 From the Envelope section of the code (Section 5)

Two items were proposed as addenda to the 2007 version of the ASHRAE 90.1 code. Addendum g updates the building envelope criteria for metal buildings. Addendum q modifies the vestibule requirements for climate zone 4.

Addenda:

<u>Addendum f</u>: This addendum sets requirements for high albedo roofs. The addendum expands the types of roofs shown by research to reduce the conduction loads through roofs into the conditioned space. This allows building design teams to select from a number of alternatives and reduce space loads, thereby reducing energy usage and cost. The changes are presented in Section 5.5.3.1.1 and 5.5.3.1.2 of the ASHRAE 90.1 2010 code as well as in Table 5.5.3.1.2 of the code. Addendum f affects medium and large office buildings, retail buildings, schools, healthcare hospitals, hotels, and apartment buildings.

<u>Addendum ag</u>: This addendum adds a requirement for joint insulation. Additions are made in section 5.8.1.10 of the code.

<u>Addendum am</u>: The purpose of this addendum is to revise air leakage criteria so that they closely reflect current practice. The addendum includes additional options for air leakage testing for fenestration and doors. The changes are presented in Section 5.4.3.2 of the ASHRAE 90.1 2010 code. All the building prototypes are affected by the changes mandated by this addendum.

<u>Addendum bf</u>: Requires continuous air barrier and performance requirements for air leakage of opaque envelope elements. The addendum modifies the language of the air barrier design requirement in Section 5.4.3.1.1 of the ASHRAE 90.1 2010 to include performance requirements for air leakage of the opaque envelope and to add and change acceptable materials and assemblies in Section 5.4.3.1.3. These addenda apply to all prototypes.

<u>Addendum bn</u>: Limits poorly oriented fenestration; favors south facing fenestration over west facing fenestration. Compliance can be shown by having more south facing fenestration than west facing fenestration. For those buildings affected by this requirement, this reduces envelope loads, energy usage and thereby costs. This approach gives flexibility to building design teams to work with building siting and fenestration orientation as well as fenestration area to comply with the requirement. This addendum provides exceptions for retail glass and buildings potentially shaded from the south or west. Also, an exception is provided for certain additions and alterations. The changes are presented in Section 5.5.4.5 and Table 11.3.1 of the ASHRAE 90.1 2010 code.

Addendum di: This addendum allows for a reduction in ventilation in uncontaminated garages.

Addendum dl: This addendum gives instruction to the users of Appendix C on how to model the base envelope design and the proposed envelope design in complying with the cool roof provisions in Section 5.*)*
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5.2.2.2 Addendums for the Mechanical section of the code (Section 6)

Addenda:
Addendum e: As per ASHRAE 62.1 specifies outdoor air intake to meet the ventilation requirements. This results in the heating, cooling and dehumidification of outdoor air which increases the energy consumption. These requirements also call for the HVAC system to provide for exhausting air. There is a potential to recover both heating and cooling energy from exhaust air. This addendum modifies the requirements for energy recovery. Energy recovery requirements are now defined by the design supply fan airflow rate, climate zone, and the % outdoor air at full design airflow rate. The specifications for energy recovery are reported in Section 6.5.6 and Table 6.5.6.1 of the ASHRAE 90.1 2010 standard. This change affects large offices, standalone retail, schools and hospitals.

Addendum v: This addendum modifies the requirements for axial fan open circuit cooling towers with provisions to calculate the pump head associated with sizing the cooling towers. The calculations are provided in Section 6.4.2 of the ASHRAE 90.1 2010 code.

Addendum ae: This change adds requirements for heating panels. Changes are provided in Section 6.4.4 of the code.

Addendum af: (Prescriptive) The addendum prescribes maximum flow rates through chilled water and condenser water piping in order to properly size these hydronic systems. The changes are described in Section 6.5.4.5 Table 6.5.4.5 of ASHRAE 90.1 2010. The modifications affect large office buildings.
Addendum aj: This addendum expands the scope of electric motors and proposes changes to energy efficiency standards for the motors that are manufactured in 2010 and beyond. The changed efficiencies are provided in Table 10.8a and Table 10.8b of the ASHRAE 90.1 2010 code.

Addendum ak: The addendum removes the requirement for VFDs on variable flow heating water systems. Other changes include lowering VFD threshold from 50 to 5 hp for chilled water systems, Limiting differential pressure setpoint and requirement of a setpoint reset with DDC and addition of water-cooled air conditioners to systems requiring isolation valves. The addendum also adds VFD pumping requirements to hydronic heat pumps and water cooled unitary air conditioners. The changes are provided in Section 6.5.4.2 of the code. Large office buildings are affected by the implementation of this addendum.

5.2.2.3 From the Lighting, Power and Other Equipment sections of the code (Section 8, 9, and 10)

Addenda:
Addendum d: Requires automatic daylighting controls when skylights are present. The addendum revises section 5.5.4.4.2, 5.8.2.1, 5.8.2.2 and 5.8.2.6. The addendum adds new sections 5.7.3, 9.4.1.3 and 9.4.1.4. The changes affect standalone retail, schools, and warehouses.

Addendum i: This proposal will apply a four-zone (e.g. city center, mixed commercial/high-rise residential, residential, and rural) lighting power density approach to exterior lighting requirements. See IESNA documents in RP-20, DG-5, IESNA Handbook, RP-2, G-1, and RP-33. Also, there is a deletion of the 5% additional power allowances, which is replaced by a base wattage allowance per site. See Tables 9.4.5and the new 9.4.6. These changes affect all the building types.

Addendum o: This addendum establishes step-down transformer efficiencies. The Energy Policy Act of 2005 created new federal minimum efficiency standards for low-voltage dry-type transformers. This addendum adopts the federal mandatory requirements by adding them to 90.1-2010. Prior to this addendum, this class of equipment had no efficiency requirements. Changes of this addendum are provided in Section 8.1, 8.4.2 and Table 8.1 of the 90.1 2010 code. This addendum affects medium and large offices, primary and secondary schools, hospitals, ware houses and high-rise apartment buildings.

Addendum x: This addendum reduces the building size threshold where automatic lighting shutoff is required from 5000sqft to any size. The addendum adds the following space types to those where occupancy sensor control is required. These include lecture halls, training rooms, supply and storage rooms (up to 1000sqft), office spaces (up to 250sqft), restrooms, dressing rooms, locker rooms, and fitting rooms. Modifications are made to Section 9.1.2, 9.4.1.1 and 9.4.1.2 of the ASHRAE 90.1 2010 code. The addendum affects all the building types.

Addendum aa: Requires automatic shutoff controls to be manual on except in certain spaces which include public corridors, stairwells, restrooms, primary building entrances, and areas where manual would endanger safety. Modifications are proposed to Section 9.4 of the ASHRAE 90.11 2010 code. This addendum affects office buildings.

Addendum ab: The addendum defines top lit and side lit daylight spaces over a certain size and adds daylighting requirements. The addendum modifies section 9.4.1.4 by reducing the minimum required combined day lit area under skylights to 4000sqft from 5000sqft. Addendum ab also introduces automatic dimming controls for side lit spaces, where the combined primary side lit area exceeds 1,000 ft2.Modifications are made to section 5.5.4.4.2, 9.4.1.3 and 9.4.1.4 of the ASHRAE 90.1 2010 code. This addendum affects medium and large offices, standalone retail, schools and warehouses.

Addendum ac: Inclusion of control factors. Control factors have been extended to other types of spaces when automatic, as opposed to when manually operated controls are employed, using the assumption that automated control systems give a similar performance irrespective of building type. The changes are implemented in section 9.1.4 and 9.6.2 as well as Table 9.6.2 of the ASHRAE 90.1 2010 code.

Addendum aj: This addendum updates motor efficiency tables for motors that are rated 1hp or larger. The changes are implemented in Section 10.4 and Table 10.8 of the ASHRAE 90.1 2010 standard. The changes affect all the building types.

Addendum al: The addendum requires skylights in spaces 10,000sqft and larger. Changes have been incorporated in Section 5.5.4.2.2 and 5.5.4.2.3 of the ASHRAE 90.1 2010 standard. The addendum affects standalone retail, secondary schools and warehouses.

Addendum ar: This addendum corrects an oversight in previous versions of the code where expanded exterior lighting power limits were put in place but the details of how to calculate the installed power and compare it to the limits was not included. Changes are presented in Section 9.1.3, 9.1.4 and 9.4.5 of ASHRAE 90.1 2010 code.

Addendum av: This proposed addendum modifies the requirements of section 9.1.2 Lighting Alterations. The requirements are changed to require that in all spaces that alterations take place that all requirements of section 9 are met not just the LPD requirements. The exception has been changed so that the LPD requirements of the Standard are met in the altered space if less than 10% of luminaires replaced. All new controls must meet the specific control of the section. Changes are reported in Section 9.1.2 of the code.

Addendum aw: Section 9.4.1.4 requires a master lighting control at the point of entry/exit for all permanently installed luminaries and switched receptacles in hotel and motel guest rooms and guest suites. This addendum modifies this requirement to allow multiple control devices that collectively control all permanently installed luminaires except those in the bathrooms. The bathrooms are required to have a separate control device capable of turning off the bathroom lighting, except night lighting not exceeding 5 W, within 60 minutes of an occupant leaving the space. The changes affect small and large hotel prototypes.

Addendum ay: The addendum changes the current specifications for the application of space LPDs. The LPDs are now based on spaces surrounded by ceiling height partitions or walls only requiring the users to identify spaces by function. Changes are presented in the revised versions of Section 9.6.1 of the ASHRAE 90.1 2010 code.

Addendum bp: This addendum allows the use of control that provides automatic 50% auto on with the capability to manually activate the remaining 50% and has full auto-off. This type of control was excluded from use in the existing language and only full manual on was allowed. Recent provided test case data shows that this control can save approximately 6% more of the lighting that is required to be occupancy sensor controlled. The changes are specified in Section 9.4 of the code.

Addendum bq: The addendum reduces the additional lighting power allowance for retail display. The addendum reduces the display lighting LPD allowances for the four sales area categories introduced in 90.1 2007. This includes the use of high performance T8s. The changes affect strip malls.

Addendum br: This adds an exterior zone 0 to cover very low light requirement areas. This will help eliminate excessive use of light in areas where none is needed other that for location marking type. The changes are provided in Table 9.4.5 and Table 9.4.6 of the ASHRAE 90.1 2010 code.

Addendum bs: This addendum requires noncritical receptacle loads to be automatically controlled based on occupancy and scheduling. This new requirement will provide the means for non-critical receptacle loads to be automatically controlled (turned off) based on occupancy or scheduling without additional individual desk top or similar controllers. The changes are presented in Section 8.4.2 of the 90.1 2010 code. These changes affect all the building types.

Addendum by: The addendum makes major changes in LPD allowances. The changes are implemented in Tables 9.5.1, 9.6.1 and Section 9.6.3 of the ASHRAE 90.1 2010 code. The changes impact all building types.

Addendum cd: The addendum requires exterior lighting control rather than just control capabilities. The addendum also adds bi-level control for general all night applications such as parking lots to reduce lighting when not needed. Furthermore, the changes add control of façade and landscape lighting not needed after midnight. These changes are presented in section 9.4.1.3 and section 9.4.5 of the code. These changes affect offices, retail buildings, schools, warehouses and restaurants.

Addendum ce: This additional control requires that all spaces (unless exempted) have multilevel control capability (also commonly known as bi-level switching). Modifications are made to Section 9.4.1.2 of the ASHRAE 90.1 2010 code.

Addendum cf: This addendum requires stairwell lighting to be controlled automatically using control devices such that the lighting power is reduced by at least 50% within 30 minutes of all occupants leaving the controlled zone. Stairwell lighting under 90.1-2010 has a lighting power allowance of 0.6 W/ft2. The changes are presented in Section 9.4.1.4 of the ASHRAE 90.1 2010 code. The changes affect all the building types except quick service restaurants.

Addendum cn: This change adds two versions of a combined advanced control to the control incentives table. These control system combinations involve personal workstation control and workstation-specific occupancy sensors for open office applications. The control incentive will apply only to particular controls when they are applied in open office areas. Modifications are made to Table 9.6.2 of the code.

Addendum ct: Requires daylight sensor control for side lit spaces 250 sq ft or larger. The changes are presented in Section 9.4.1.3 of the ASHRAE 90.1 2010 standard. The changes affect offices, schools, healthcare buildings, hotels, warehouses and restaurants.

Addendum cv: This addendum adds energy efficiency requirements for service water pressure booster systems.

Addendum cz: This change incorporates bi-level control for parking garages to reduce the wasted energy associated with unoccupied periods for many garages and allows an exception for lighting in the transition areas to accommodate IES recommendations.

Addendum dc: The conditions and common practice that existed to create the need for this requirement on tandem wiring are no longer practiced primarily with the new federal efficacy requirements and products available on the market.

Addendum dd: The addendum reduces the area threshold where skylights are required to be designed into building spaces down to 5000sqft and similarly reduces the threshold where daylighting controls must be applied to 900sqft. The changes are presented in Section 5.5.4.2.2, 5.5.4.2.3, 9.4.1.4 and Table 9.6.2 of the ASHRAE 90.1 2010 code. The changes affect primary schools and warehouses.

Addendum de: Reduces lighting power allowance for some lobbies to reflect advances in lighting technologies. The changes are presented in Table 9.6.1 of the ASHRAE 90.1 2010 code. The changes affect office buildings, schools, healthcare buildings, and small hotels.

Addendum df: The addendum adds requirements for elevator ventilation and lighting. The changes are implemented in Section 10.4.3 of the ASHRAE 90.1 2010 standard. The changes affect medium and large offices, secondary schools, healthcare buildings, hotels and apartment buildings.

Addendum do: This addendum attempts to clearly establish the goals and requirements of the lighting system including controls and to ensure that the owner is provided all information necessary to best use and maintain the lighting systems.

Addendum dr: The original purpose for this provision was to limit the use of inefficient lighting sources for high wattage applications when there was not a comprehensive table od exterior LPD limits. With the table of requirements now in 2007 and beyond versions of the standard, the need for this limit is superseded.

Addendum dq: This addendum modifies the calculations found in Appendix C in order to reflect modifications to the modeling assumptions in the equations.

Addendums out for public review:
"by" LPDs
"dd" Toplighting change to 900 sq ft
"dc" remove Tandem wiring
"cz" Parking garage control + exception
"cu" Nighttime emergency lighting control
"ct" daylighting change to 250 sq ft
"cs" receptacle control refinements
"cn" advanced lighting control
"cf" stairway lighting control
"ce" multi-level control
"cd" exterior control
"bz" electrical monitoring
"cx" 40% allowance - Working group is formed and meeting

5.2.2.4 From the Energy Cost Budget Subcommittee and Appendix G of the code (Section 11)

Addendum ai: This addendum is intended to reduce the inequities typically associated with modeling district cooling systems per the requirements of Appendix G of ASHRAE/IESNA Standard 90.1-2007. For a fair comparison of district cooling systems, the addendum requires a baseline that also uses purchased chilled water. This addendum details the modifications that are made to the baseline HVAC system when purchased chilled water or heat are included. The changes are presented in Section G3.1.1.1 – G3.1.1.3 of the ASHRAE 90.1 2010 code.

Addendum bj: This adds an exception within Appendix G that allows users to claim energy cost savings credit for the increases ventilation effectiveness of certain HVAC system designs. The best example is a displacement ventilation system. The changes are proposed in Section G 3.1.2.5 of the ASHRAE 90.1 2010 code.

Addendum cr: The definition for an unmet load hour is currently lacking a throttling range or limit to the setpoint. It was decided that the baseline and proposed shall have the same thermostat throttling range. This required additional language in the unmet load hour definition as to how throttling range effects determination of an unmet hour along with additional language in Table 11.3.1 and Table G3.1, design model sections.

It was also discussed to remove the requirement that the proposed unmet hours be no more than 50 greater than baseline unmet hours. Several LEED reviewers commented that they had required an analysis to be modified to meet the 50 hour limit, which proved very difficult to do, and resulted in no appreciable differences in the results, as long as the 300 hour total limit on loads not met was not violated. It appears to be a burdensome requirement that does not result in a better or more accurate accounting of savings. Section 11.3.2i was revised to require both the proposed and baseline unmet hours be no greater than 300 in both the baseline and proposed. This is the same language used for unmet hours in Appendix G.

Lastly it was decided to remove the language allowing modification of the system coil capacities to reduce unmet hours as needed. The consensus of the ECB subcommittee and of other modelers was that loads not being met were almost never a result of undersized equipment, but rather some other fundamental flaw in the model.

Addendum cw: These changes address corrections and clarifications necessary to Section 11, Table 11.3.1 and Section 11 Service Water Systems.

Addendum da: The intent of this addendum is to establish that the Appendix G baseline shall be based on the minimum ventilation requirements required by local codes or a rating authority and not the proposed design ventilation rates. The changes are specified in Section G3.1.2.5 exception c of the ASHRAE 90.1 2010 code.

Addendum db: This addendum modifies supply air to room air temperature difference for laboratories and the fan power requirements in appendix G section of the code. Changes are implemented in Section G3.1.2 of the code.

Addendum dg: This addendum adds a definition for the term field fabricated used in Section 5.4.3.2, which is similar to the definition in California's Title 24. This change also modifies Table G3.1 of the ASHRAE 90.1 2010 code.

Addendum dn: This addendum modifies the efficiencies of variable refrigerant flow equipment. This change is specified in Section G3.1.1 of the ASHRAE 90.1 2010 code.

5.3 Laboratory's TERP Web Site "esl.tamu.edu/terp"

Since the fall of 2001, the Laboratory has maintained a TERP webpage, where information is provided to builders, code officials, the design community and homeowners about TERP. In 2010, the Laboratory redesigned its website to make navigation easier. On the navigation bar is a tab that links to the TERP homepage (Figure 116). The homepage contains the following items:

- Definition of the Texas Emissions Reduction Plan
- Texas Work
    - TERP Objectives
    - TERP Elements
    - ESL's TERP Responsibilities
    - Links to
        - Texas Legislative Testimony by the ESL
        - TERP Legislative History
- National Work
    - National Center of Excellence on Displaced Emission Reductions (CEDER)
    - Links to
        - CEDER Program

- EPA Recognizes ESL and Dallas Partners

In addition, the TERP homepage also includes a sidebar on the left with links to the latest articles and news.

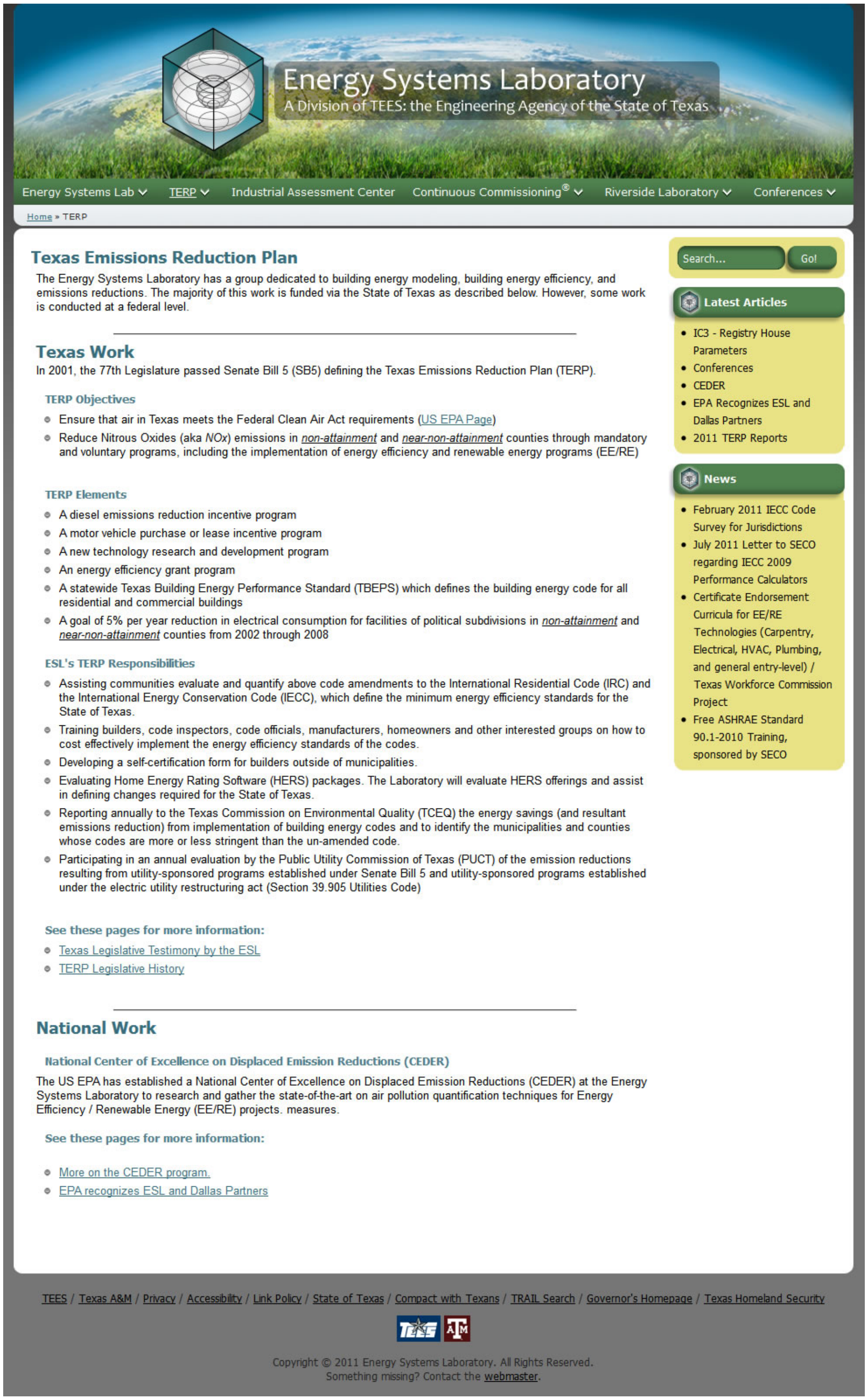


Figure 116: TERP Home Page

The TERP tab also contains a dropdown menu which provides links to the following sections (Figure 117):

- Code Compliance Calculator
    - IC3
        - Help and Support – contains IC3 Help Resources including
            - Supplemental Release Notes
            - What's New in this Version?
            - Manual
            - Detailed Release Notes for current release of IC3
            - Aggregate Reports from IC3 – Location, parameters and maps.
            - Contact information
            - RESNET Certification Resources
        - News – includes information about improvements and fixes to IC3
        - Workshops – description of IC3 Workshops, including contact information
        - FAQs
        - IC3 Reports – contains data from ESL's research and software projects
            - IC3 – Registry House Parameters (updated monthly)
                - Envelope
                - Systems
                - Mixed
            - Texas Building Registry Demographics
                - Texas
                - Counties
                - Cities
                - TCV (Travis County & Austin)
            - Weather Data
    - TCV
        - Help & Support – contains TCV Help & Support and contact information
        - News – includes TCV News including
            - What's New in Version 1.1
            - What is the Difference between TCV v1.1 and IC3 v3.x?
        - FAQs
    - Credits
- Letters and Reports
    - Legislative Documents
    - Builders Information
    - EPA/CEDER Work
        - Background
        - Reports provided to US EPA as part of CEDER Program
    - Reports – listed by year from 2002-2010
- About
    - Legislative Testimony
    - Legislative Documents
    - Legislative History
- TERP Data Sets

  - Weather Data
  - Texas Building Registry
    - IC3/TCV Usage Reports
    - IC3 House Construction Trends

- TERP Links
  - eCalc Emissions & Energy Calculator
  - International Code Compliance Calculator (ICCC)
  - Public Utility Commission of Texas (PUC)
  - U.S. Department of Energy (DOE)
  - Texas State Conservation Office (SECO)
  - U.S. Environmental Protection Agency (EPA)
  - International Code Council (ICC)
  - American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - North Central Texas Council of Governments (NCTCOG)
  - Alamo Area Council of Governments (AACOG)
  - Circle of Ten
  - Texas Home Energy Rating Organization (TxHERO)

- Other Publications
  - Builders Information
  - Digital Library
  - Presentations
  - Proceedings
    - Air Quality (CATEE)
    - Hot & Humid
    - IBPSA
    - ICEBO
    - IETC

- Workshops
  - IC3
  - IECC Residential
  - IECC Commercial
  - ASHRAE

Figure 117: TERP Links

5.3.1 Provide Technical Assistance to the TCEQ

The Laboratory received dozens of calls per week from code officials, builders, home owners and municipal officials regarding the building code and emissions calculations. A complete file of these transactions is maintained at the Laboratory.

5.3.2 Delivered "Statewide Air Emissions Calculations from Wind and Other Renewables: Summary Report January 2010 – December 2010," to the Texas Commission on Environmental Quality in August 2010, revised November 2009 (Figure 47)

The Energy Systems Laboratory, in fulfillment of its responsibilities under this Legislation, submits its third annual report, "Statewide Air Emissions Calculations from Wind and Other Renewables," to the Texas Commission on Environmental Quality.

The report is organized in several deliverables:

- A Summary Report, which details the key areas of work;
- Supporting Documentation;
- Supporting data files, including weather data, and wind production data, which have been assembled as part of the third year's effort.

The executive summary provides summaries of the key areas of accomplishment this year, including:

- Continuation of stakeholder's meetings;
- Analysis of power generation from wind farms using improved method and 2006 data;
- Analysis of emissions reduction from wind farms;
- Updates on degradation analysis;
- Analysis of other renewables, including: PV, solar thermal, hydroelectric, geothermal and landfill gas;
- Review of electricity generation by renewable sources and transmission planning study reported by ERCOT;
- Review of combined heat and power projects in Texas; and
- Preliminary reporting of NOx emissions savings in the 2007 Integrated Savings report to the TCEQ.

5.3.2.1 Analysis of wind farms using improved method and 2010 data

In this report, the weather normalization procedures developed together with the Stakeholders were presented and applied to all the wind farms that reported their data to ERCOT during the 2007 measurement period, together with wind data from the nearby NOAA weather stations. In the 2008 Wind and Renewables report to the TCEQ (Haberl et al. 2008), weather normalization analysis methods were reviewed. An analysis was shown for the Sweetwater I wind farm in Nolan, Texas, and then applied to all the wind farms in the ERCOT region.

The wind farm (Sweetwater III) was used as an example in this report to present the same weather normalization procedure, including the processing of weather and power generation data, modeling of daily power generation versus daily wind speed using the ASHRAE Inverse Model Toolkit (IMT) for two separate periods, i.e., Ozone Season Days period (OSP), from July 15 to September 15, and Non-Ozone
Season days period (Non-OSP); prediction of 1999 wind power generation using developed coefficients from 2007 daily OSP and Non-OSP models; and the analysis on monthly capacity factors generated using the models.

Then, a summary of total predicted wind power production in the base year (1999) for all of the wind farms in the ERCOT region using the developed procedure was presented and the new wind farms which started operation in 2007 were added. The total measured wind power generation in 2007 was 8,752,498 MWh, which is 17% less than what the same wind farms would have produced in 1999. The measured wind power generation in the OSP of 2007 was 20,094 MWh/day, which is 25% lower than the estimated 1999 OSD wind production.

This report also includes an uncertainty analysis that was performed on all the daily regression models for the entire year and Ozone Season Period.

5.3.2.2 Analysis of emissions reductions from wind farms

In this report, the procedure for calculating annual and peak-day, county-wide NOx reductions from electricity savings from wind projects implemented in the Power Control Areas in ERCOT listed in the EPA's eGRID was presented, including assigning the wind farms to PCA based on the information provided by the PUCT, and calculating the NOx emission reductions based on the special version of 2007 eGRID developed by the EPA for the TCEQ. According to the developed models, the total MWh savings in the base year 1999 for the wind farms within the ERCOT region were10,226,401 MWh and 25,152 MWh/day in the Ozone Season Period. The total NOx emissions reductions across all the counties amount to 6,051 tons/yr and 15 tons/day for the Ozone Season Period.

The ESL has been working with the EPA and TCEQ regarding a new version of eGRID for all ERCOT counties in Texas. A new version of eGRID was developed and presented in this report, which is based on the ERCOT congestion management zones. As the TCEQ moves the base year to more recent years, this updated version of eGRID, representing the current Texas market, may be used to estimate the emissions reduction from wind power in the next year's report.

5.3.2.3 Preliminary reporting of NOx emissions savings in the 2008 Integrated Savings report to TCEQ

In this report, the NOx emissions savings from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the cumulative savings estimates from all projects projected through 2020 for both the annual and Ozone Season Day (OSD) NOx reductions. The NOx emissions reduction from all these programs were calculated using estimated emissions factors for 2007 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose.

5.3.2.4 Development of a degradation analysis

This report contains an updated analysis to determine what amounts of degradation could be observed in the measured power from Texas wind farms. Currently, the TCEQ uses a very conservative 5% degradation per year for the power output from a wind farm when making future projections from existing wind farms. Accordingly, the TCEQ asked the ESL to evaluate any observed degradation from the measured data for Texas wind farms. To accomplish this, nine wind farms (12 sites) from 2002 to 2007 and two wind farms (Brazos wind ranch and Sweetwater) from 2004 to 2007 were evaluated with a total capacity of 1208 MW.

In this analysis, a sliding statistical index was established for each site that uses 10th, 25th, 50th, 75th, 90th, and 99th percentiles of the hourly power generation over a 12-month sliding period, as well as mean, minimum and maximum hourly power generation of the same 12-month period. These indices are then displayed using one data symbol for each 12-month slide, beginning from the first 12-month period until the last 12-month period for each of the wind farms.

Of the 14 sites analyzed, ten sites showed an increase when one compares the 90th percentile of whole period to the 90th percentile of the first 12-month period, ranging from 3.5% to 23.7%. The remaining four sites showed a decrease from -3.2% to -18.1%. The weighted average of this increase across all wind farms studied is 8.7% (positive), which indicates that no degradation was observed from the aggregate energy production from these wind farms over the studied operation period.

5.3.2.5 Analysis of other renewable sources

Other renewable energy projects throughout the state of Texas were located to determine NOx emissions reduction and are included in this section. Searches were conducted on five specific categories which include solar photovoltaic, solar thermal, geothermal, hydroelectric, and Landfill Gas-Fired Power Plants. Many newly located renewable energy projects are assembled for inclusion in this report.

5.3.2.6 Review of electricity savings and transmission planning study reported by ERCOT

In this report, the information posted on ERCOT's Renewable Energy Credit Program site www.texasrenewables.com is reviewed. In particular, information posted under the "Public Reports" tab was downloaded and assembled into an appropriate format for review. This includes ERCOT's 2001 through 2008 reports to the Legislature and information from ERCOT's listing of REC generators.

5.3.2.7 Review of Combined Heat and Power Projects in Texas

A summary of all the Combined Heat and Power (CHP) applications in Texas and analysis on how it can impact the NOx emissions was provided in this section. As of 2007, 16,829 MW of CHP technologies were integrated into infrastructure served by the Texas electrical grid according to the database maintained by the DOE and Oak Ridge National Laboratory.

ESL-TR-09-08-03

ENERGY EFFICIENCY/RENEWABLE ENERGY IMPACT IN THE TEXAS EMISSIONS REDUCTION PLAN (TERP)

PRELIMINARY REPORT: INTEGRATED NOX EMISSIONS SAVINGS FROM EE/RE PROGRAMS STATEWIDE

Annual Report to the
Texas Commission on Environmental Quality
January 2008 – December 2008

TCEQ

Jeff Haberl, Ph.D., P.E.; Charles Culp, Ph.D., P.E.
Bahman Yazdani, P.E.; Don Gilman, P.E.
Zi Liu, Ph.D., Juan-Carlos Baltazar-Cervantes, Ph.D.
Cynthia Montgomery, Kathy McKelvey,
Jaya Mukhopadhyay, Larry Degelman, P.E.

August 2009
Revised November 2009

ENERGY SYSTEMS LABORATORY

Texas Engineering Experiment Station
Texas A&M University System

Figure 118: Cover Page of "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)," Revised November 2009

5.3.3 Technical Assistance

The Laboratory provides technical assistance to the TCEQ, the PUC, SECO and ERCOT, as well as Stakeholders participating in a number of conferences and presentations. In 2009, the Laboratory continued to work closely with the TCEQ to develop an integrated emissions calculation, which provided the TCEQ with a creditable NOx emissions reduction from energy efficiency and renewable energy (EE/RE) programs reported to the TCEQ in 2005, 2006, 2007, 2008, 2009, and 2010 by the Laboratory, PUC, SECO, and Wind-ERCOT.

The Laboratory has also enhanced the previously developed emissions calculator by: expanding the capabilities to include all counties in ERCOT, including the collection and assembly of weather from 1999 to the present from 17 NOAA weather stations, and enhancing the underlying computer platform for the calculator.

The Laboratory has and will continue to provide leading edge technical assistance to counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering the emissions and improving the air for all Texans. The Laboratory will continue to provide superior technology to the State of Texas through efforts with the TCEQ and US EPA. The efforts taken by the Laboratory have produced significant success in bringing EE/RE closer to US EPA acceptance in the SIP.

Table 1: 2000/2001 IECC Performance Path vs. 2009 IECC Performance Path

County	IECC 2009 Weather Zones	Energy Type**	Total Annual Savings of the IECC 2009 Performance Path compared to the IECC 2000/2001 (%)*	
			Gas Heating, DHW	Heat Pump Heating, Electric DHW
Houston (HAR)	2A	Site	10.9 %	10.9 %
		Source	11.9 %	10.9 %
Brownsville (CAM)	2B	Site	16.4 %	13.6 %
		Source	15.1 %	13.6 %
Dallas (TAR)	3A	Site	12.8 %	10.8 %
		Source	12.3 %	10.8 %
El Paso (ELP)	3B	Site	10.2 %	10.0 %
		Source	11.2 %	10.0 %
Amarillo (ARM)	4B	Site	16.0 %	14.6 %
		Source	16.7 %	14.6 %

**Base-case Simulation Assumptions:* Analysis used single-family house, 2,500 ft^2, single story, four bedrooms, slab-on-grade, ducts in the unconditioned, ventilated attic, window-to-floor ratio: 18% for 2000/2001, 15% for 2009, windows equally distributed (N,E,S,W), and no exterior shading. HVAC Distribution efficiency: 0.8 for 2000/2001, 0.88 for 2009. All other roof, wall and window parameters as per 2000/2001 and 2009 IECC for county shown (IC3 ver. 3.03.02).

***Source Energy Consumption*: A factor of 3.16 was used to calculate the source electricity consumption. A factor of 1.1 was used to calculate source gas energy consumption.

Table 2: 2000/2001 IECC Performance Path vs. 2009 IECC Prescriptive Path

County	IECC 2009 Weather Zones	Energy Type**	Total Annual Savings of the IECC 2009 Prescriptive Path compared to the IECC 2000/2001 (%)*	
			Gas Heating, DHW	Heat Pump Heating, Electric DHW
Houston (HAR)	2A	Site	7.8 %	8.7 %
		Source	9.1 %	8.7 %
Brownsville (CAM)	2B	Site	14.3 %	11.6 %
		Source	13.0 %	11.6 %
Dallas (TAR)	3A	Site	9.6 %	8.6 %
		Source	9.6 %	8.6 %
El Paso (ELP)	3B	Site	7.0 %	8.3 %
		Source	8.9 %	8.3 %
Amarillo (ARM)	4B	Site	10.7 %	11.9 %
		Source	13.1 %	11.9 %

**Base-case Simulation Assumptions:* Analysis used single-family house, 2,500 ft^2, single story, four bedrooms, slab-on-grade, ducts in the unconditioned, ventilated attic, window-to-floor ratio: 18% for 2000/2001, 15% for 2009, windows equally distributed (N,E,S,W), and no exterior shading. HVAC Distribution efficiency: 0.8 for 2000/2001; for 2009 IECC, HVAC distribution efficiency simulated using R8 insulation for supply, R6 for return ducts and total duct leakage of 11% to outdoor. All other roof, wall and window parameters as per 2000/2001 and 2009 IECC for county shown (IC3 ver. 3.03.02).

***Source Energy Consumption*: A factor of 3.16 was used to calculate the source electricity consumption. A factor of 1.1 was used to calculate source gas energy consumption.

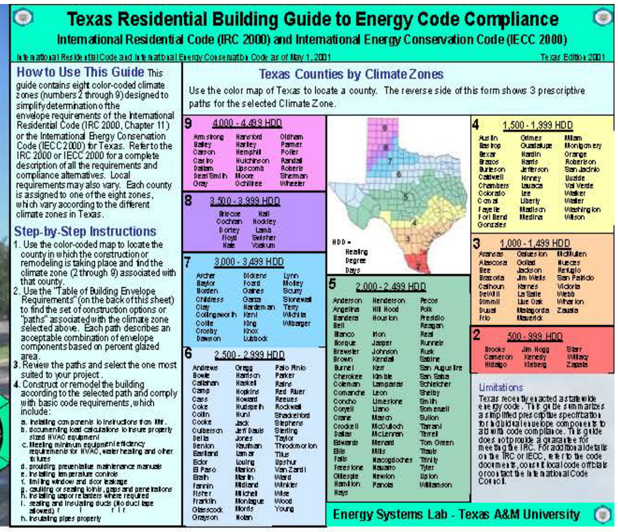
Table 3: 2000/2001 IECC Performance Path vs. Chapter 11 of the 2009 IRC Prescriptive Path

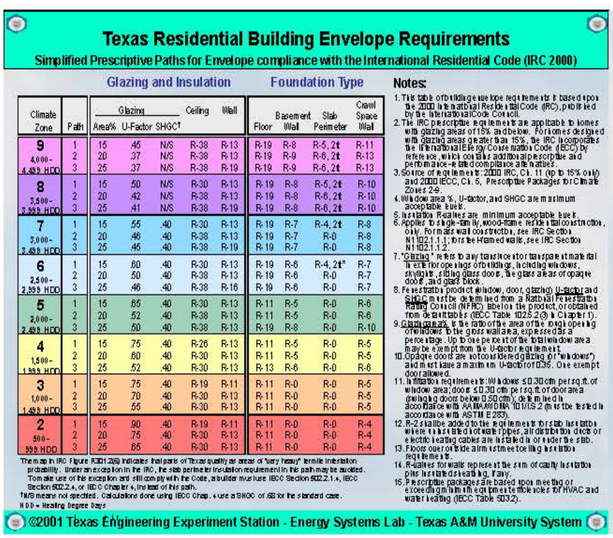
County	IECC 2009 Weather Zones	Energy Type**	Total Annual Savings of the IRC 2009 compared to the IECC 2000/2001 (%)*	
			Gas Heating, DHW	Heat Pump Heating, Electric DHW
Houston (HAR)	2A	Site	7.7 %	7.7 %
		Source	8.3 %	7.7 %
Brownsville (CAM)	2B	Site	13.7 %	10.4 %
		Source	11.8 %	10.4 %
Dallas (TAR)	3A	Site	9.9 %	7.8 %
		Source	9.0 %	7.8 %
El Paso (ELP)	3B	Site	7.1 %	7.1 %
		Source	7.9 %	7.1 %
Amarillo (ARM)	4B	Site	10.7 %	11.9 %
		Source	13.1 %	11.9 %

**Base-case Simulation Assumptions:* Analysis used single-family house, 2,500 ft^2, single story, four bedrooms, slab-on-grade, ducts in the unconditioned, ventilated attic, window-to-floor ratio: 18% for 2000/2001, 15% for 2009 IRC, windows equally distributed (N,E,S,W), and no exterior shading. HVAC Distribution efficiency: 0.8 for 2000/2001; for 2009 IRC, HVAC distribution efficiency simulated using R8 insulation for supply, R6 for return ducts and total duct leakage of 11% to outdoor. All other roof, wall and window parameters as per 2000/2001 and 2009 IRC for county shown (IC3 ver. 3.03.02).
***Source Energy Consumption*: A factor of 3.16 was used to calculate the source electricity consumption. A factor of 1.1 was used to calculate source gas energy consumption.

5.3.3.1 Presentation to SimBuild (August 2010)

In August of 2010, Dr. Jeff Haberl made three presentations at the SimBuild Conference in New York.





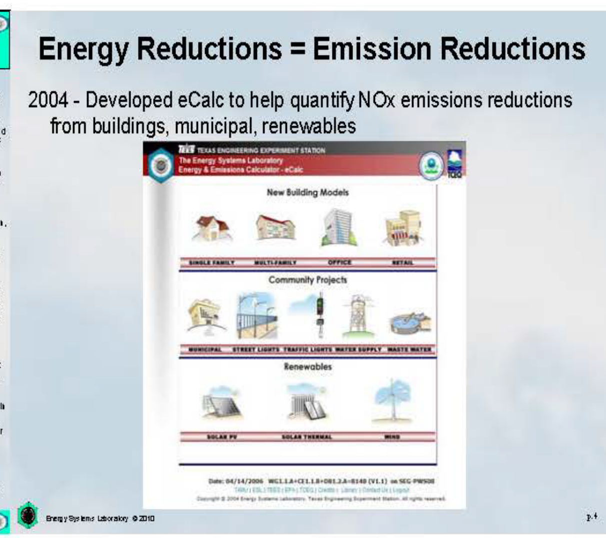
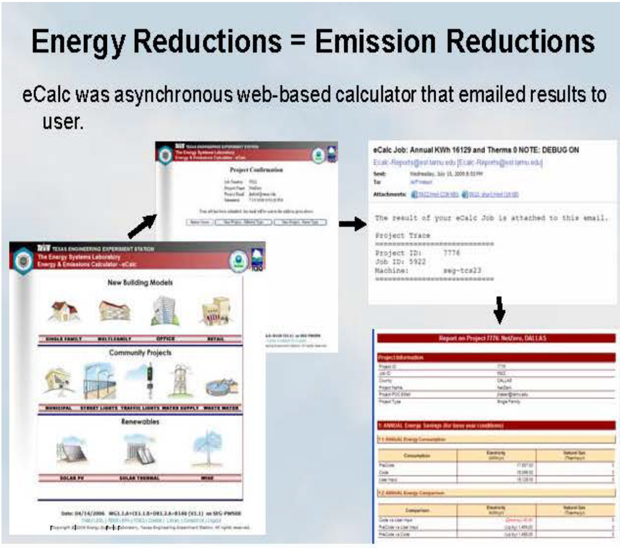
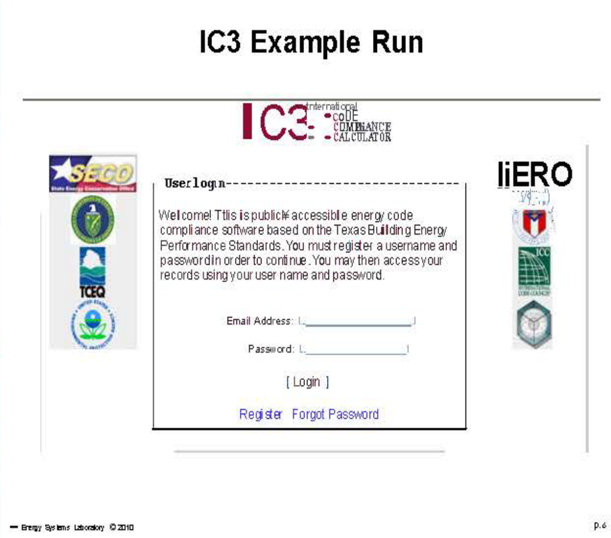
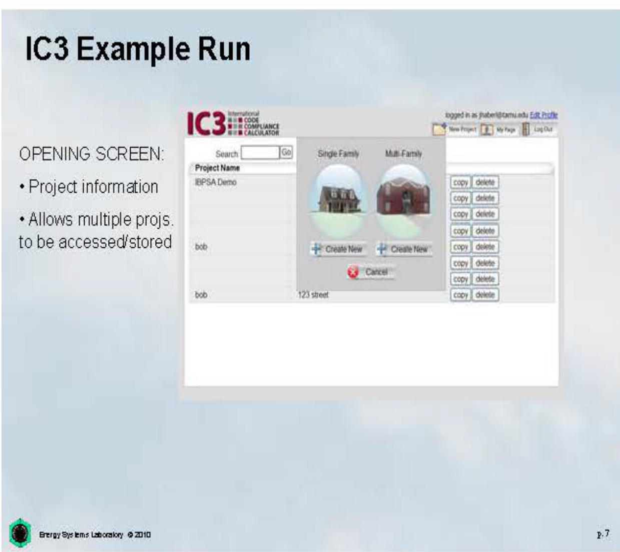


Figure 119 : Presentation to SimBuild Conference, New York (August 2010) (Part 1)







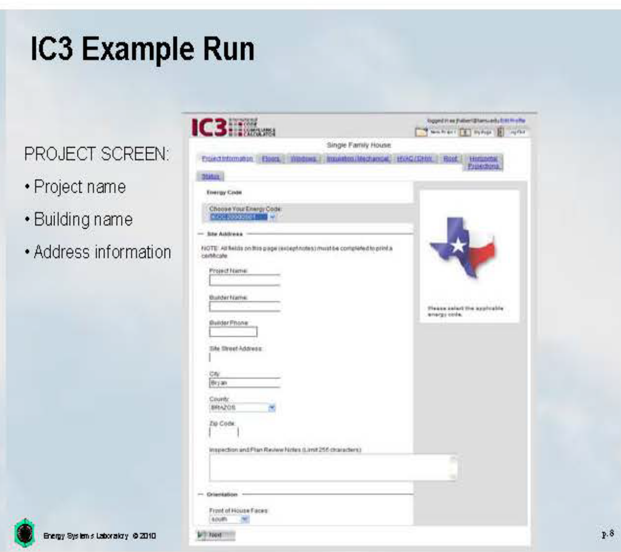
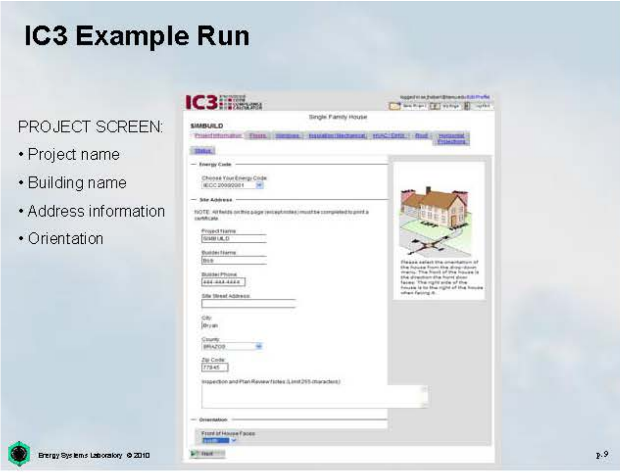
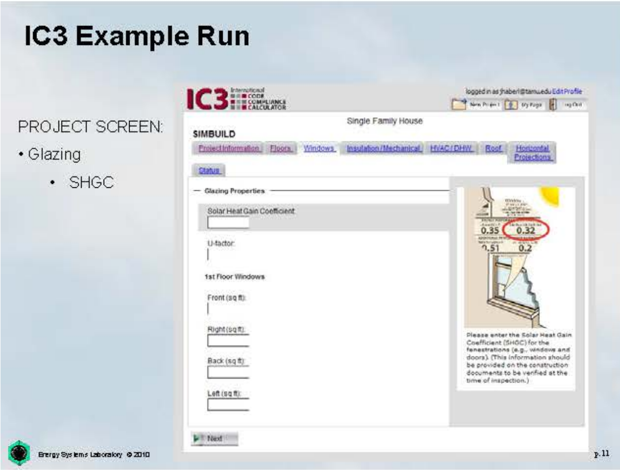


Figure 120: Presentation to SimBuild Conference, New York (August 2010) (Part 2)





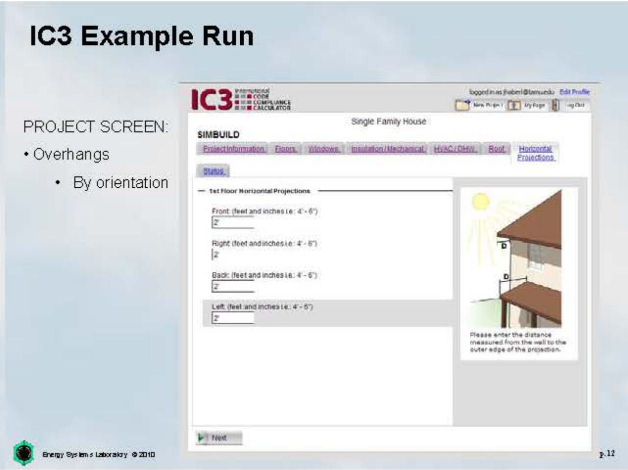
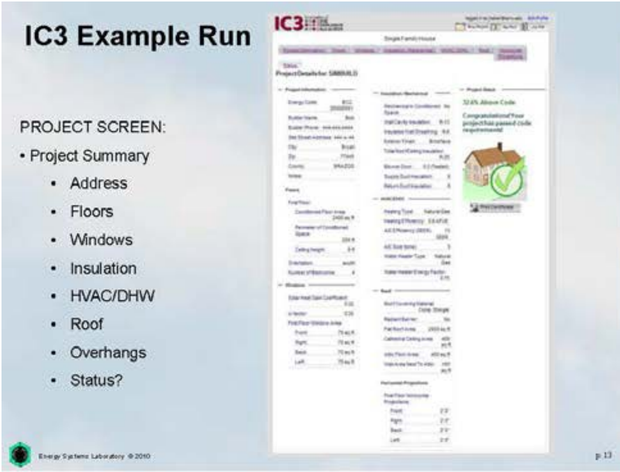
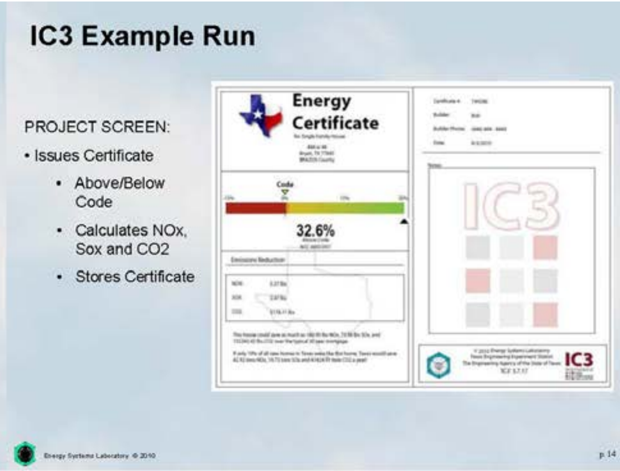


Figure 121: Presentation to SimBuild Conference, New York (August 2010) (Part 3)





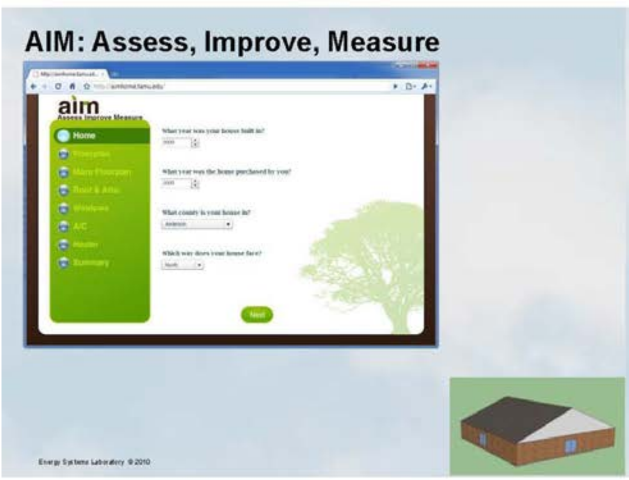
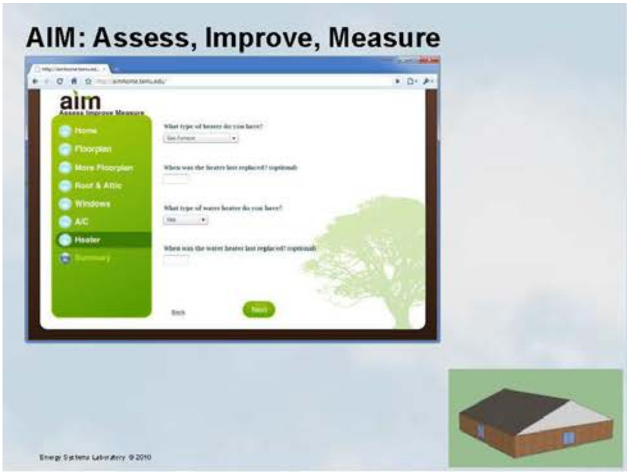


Figure 122: Presentation to SimBuild Conference, New York (August 2010) (Part 4)

Figure 123: Presentation to SimBuild Conference, New York (August 2010) (Part 5)



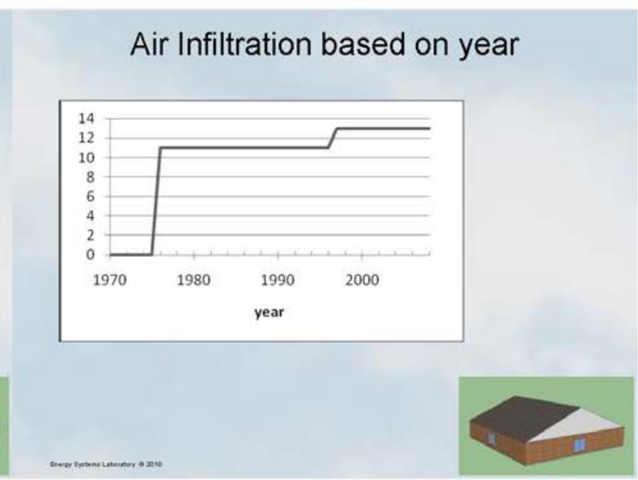
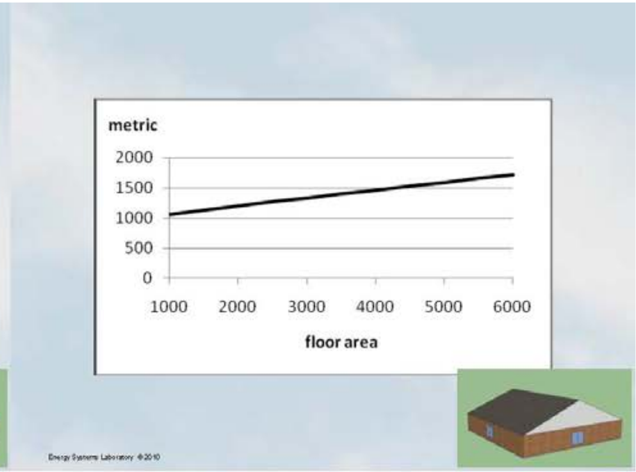


Figure 124: Presentation to SimBuild Conference, New York (August 2010) (Part 6)



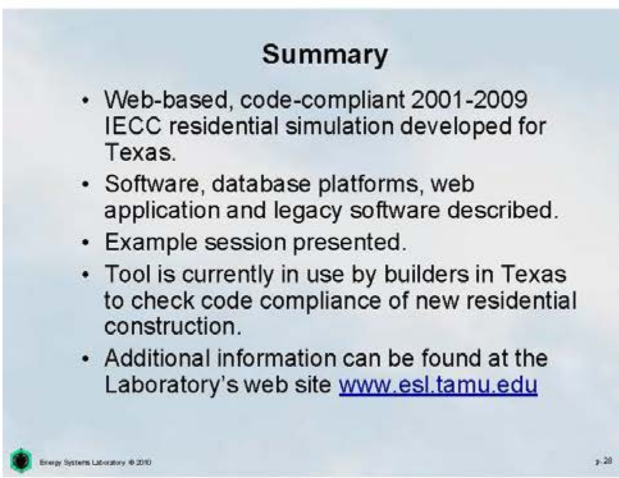


Figure 125: Presentation to SimBuild Conference, New York (August 2010) (Part 7)

The second presentation was based on a web-based calculator for residential.

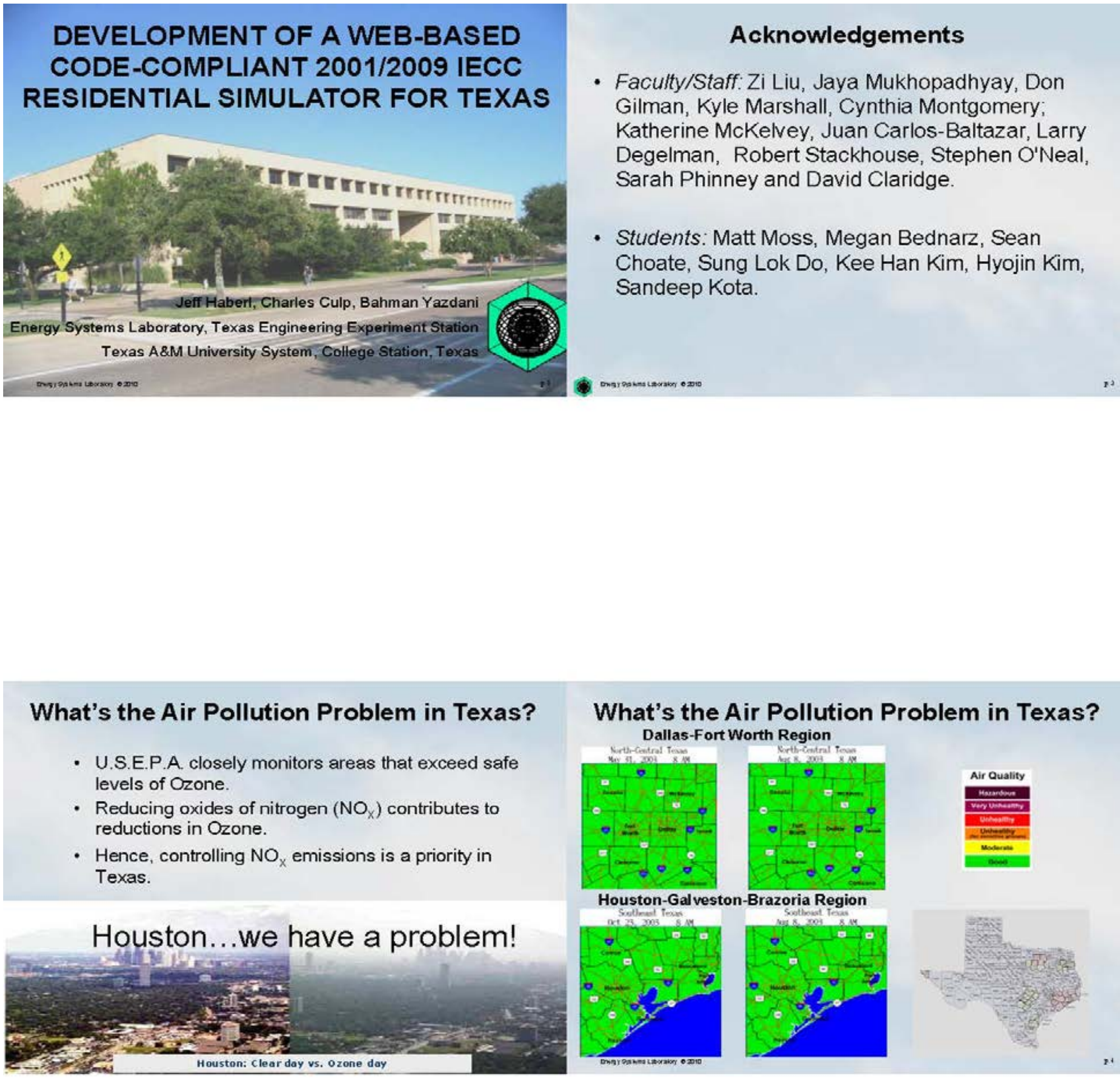
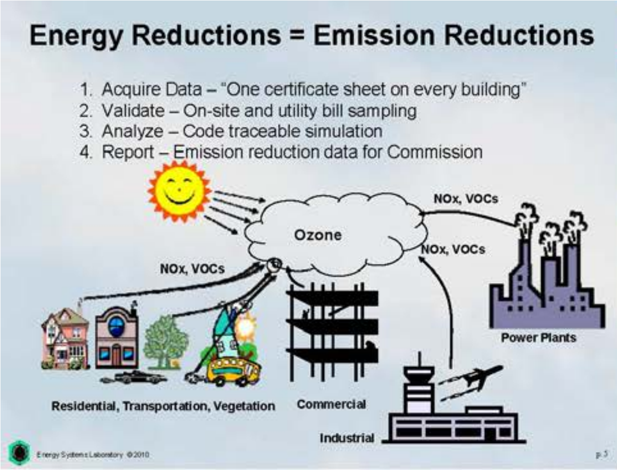
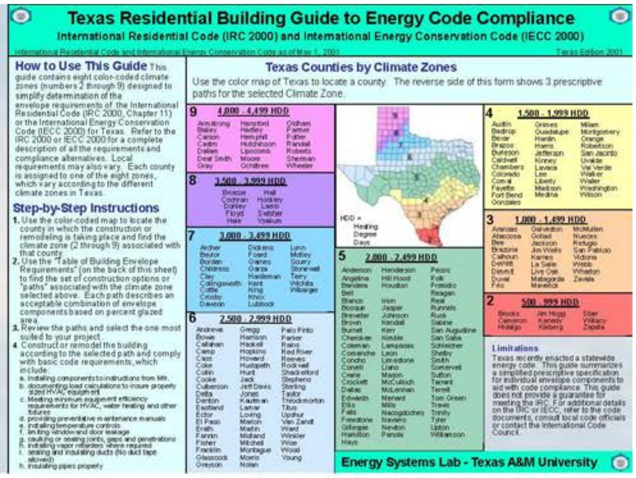
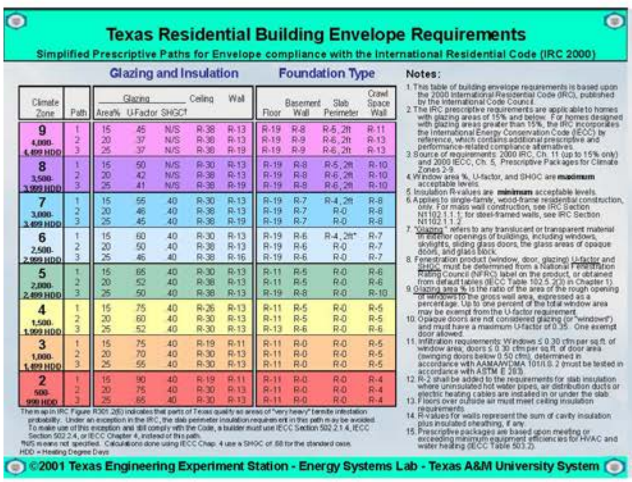


Figure 126: Presentation to SimBuild Conference, New York (August 2010) (Part 1)







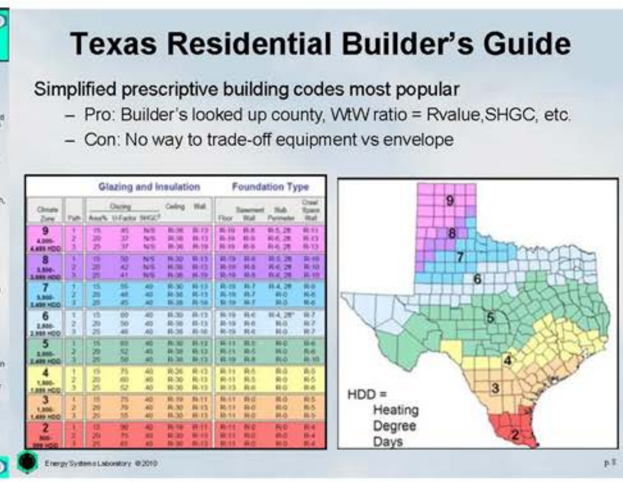
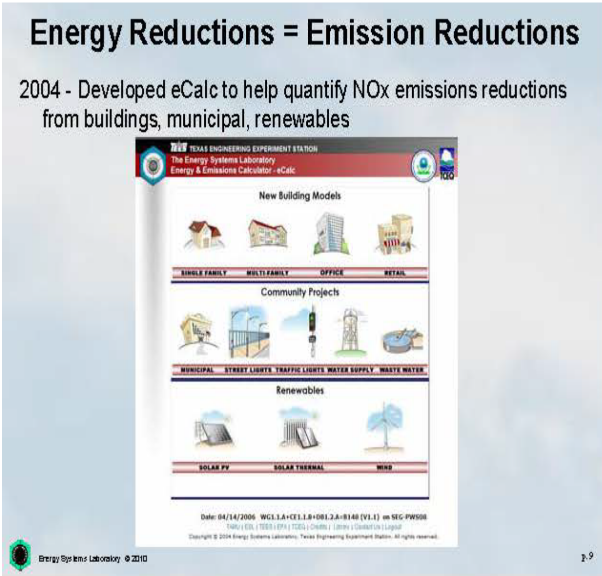
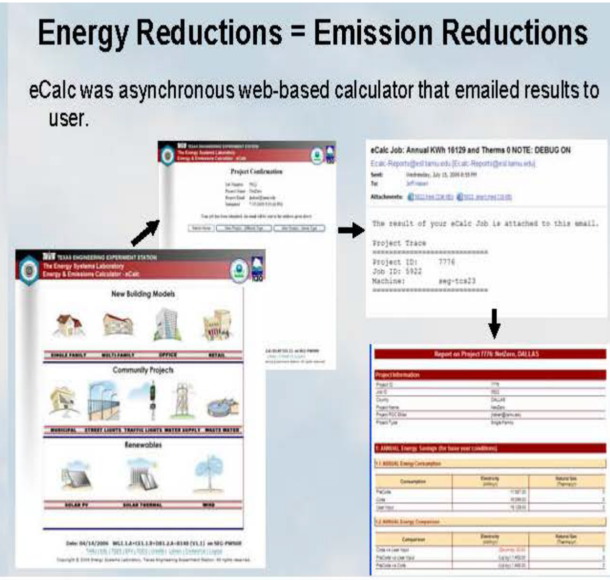
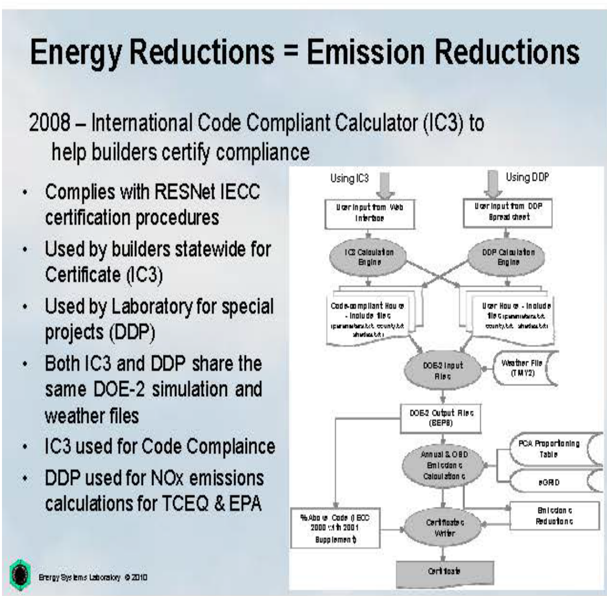


Figure 127: Presentation to SimBuild Conference, New York (August 2010) (Part 2)







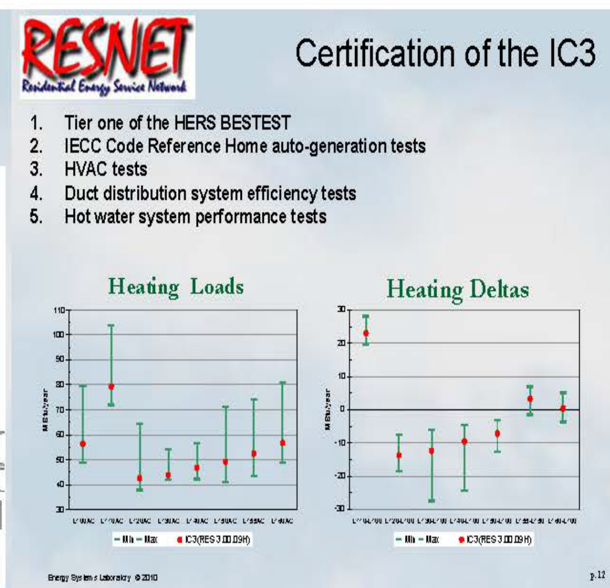
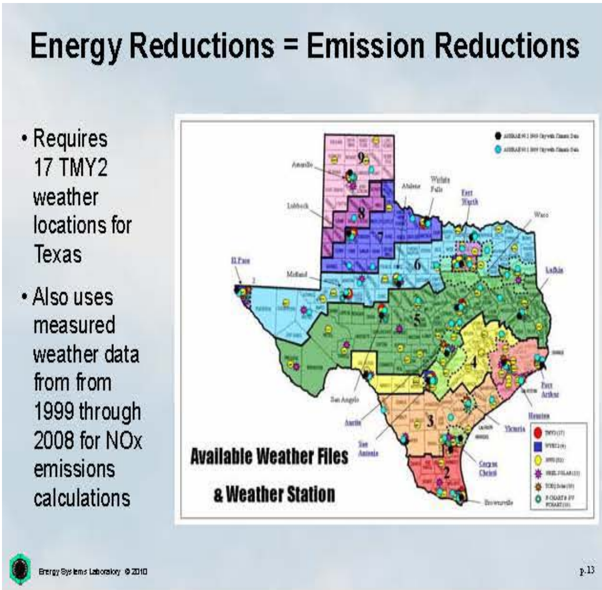
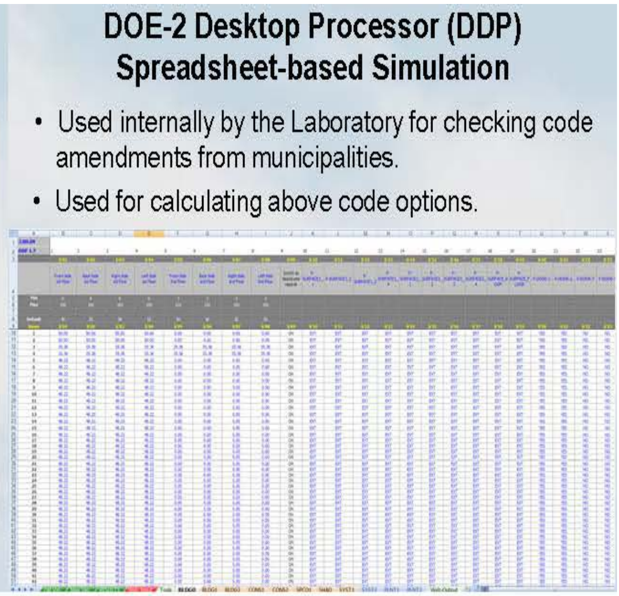
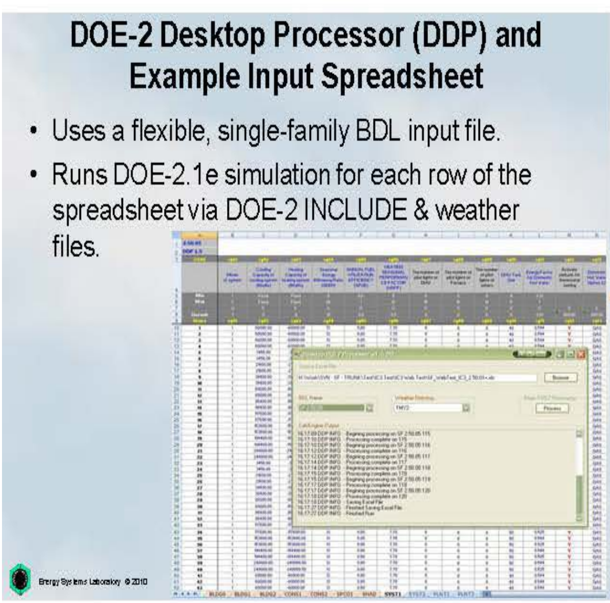


Figure 128: Presentation to SimBuild Conference, New York (August 2010) (Part 3)







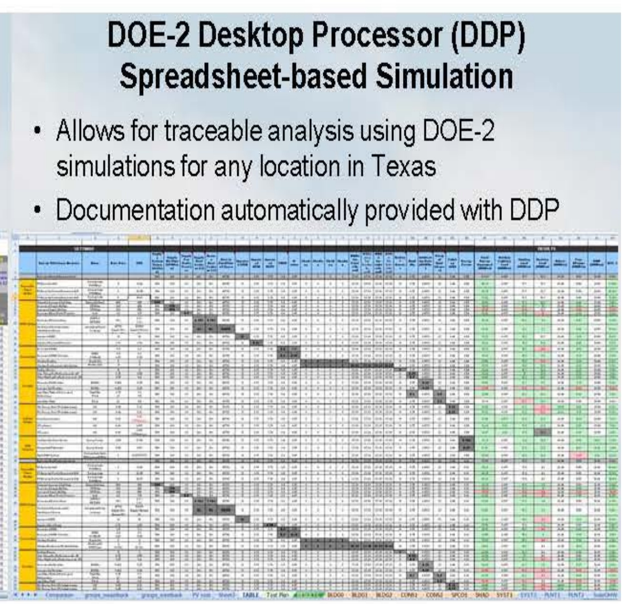
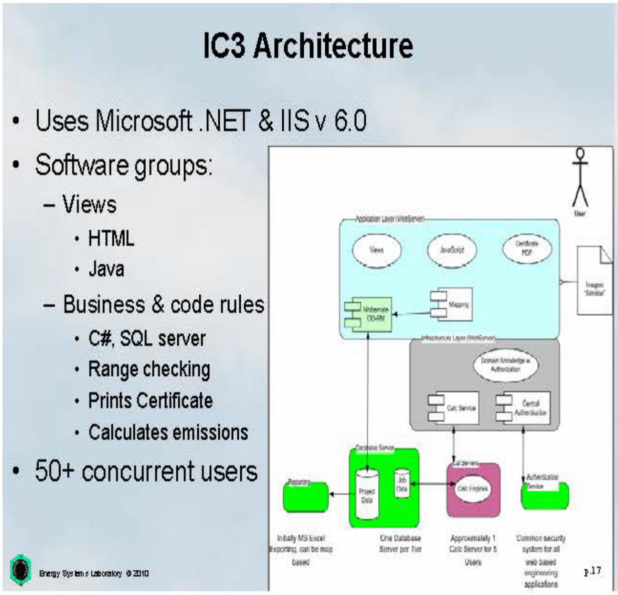
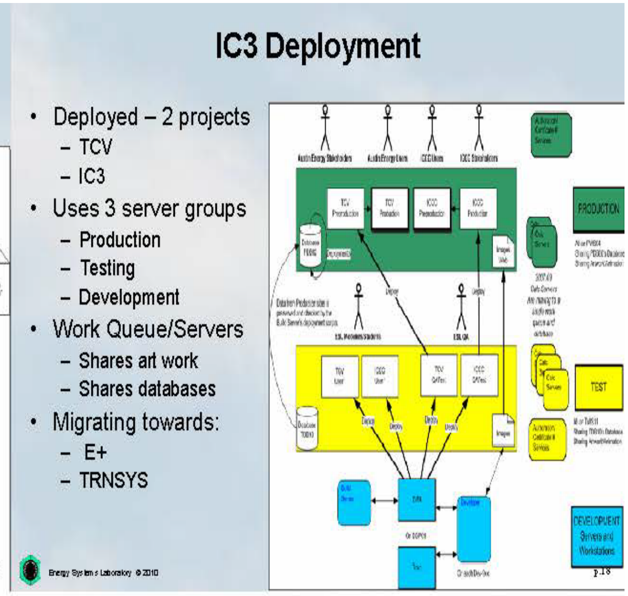


Figure 129: Presentation to SimBuild Conference, New York (August 2010) (Part 4)





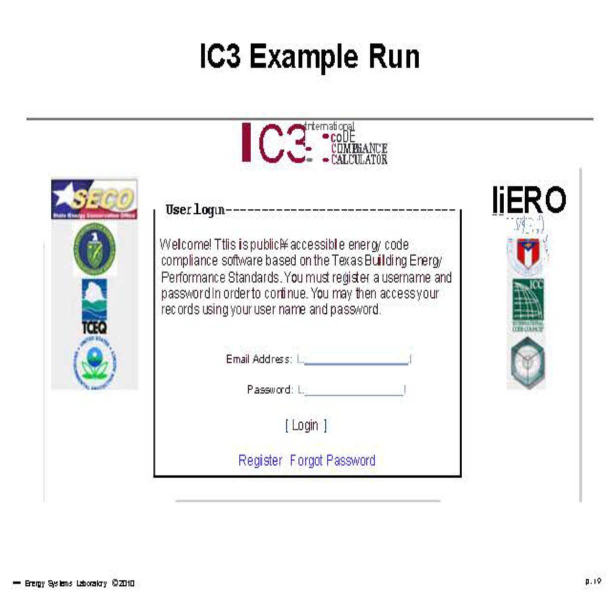
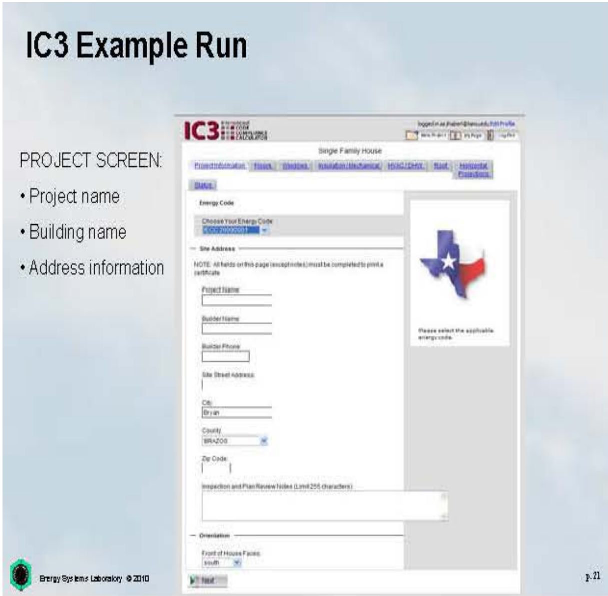


Figure 130: Presentation to SimBuild Conference, New York (August 2010) (Part 5)



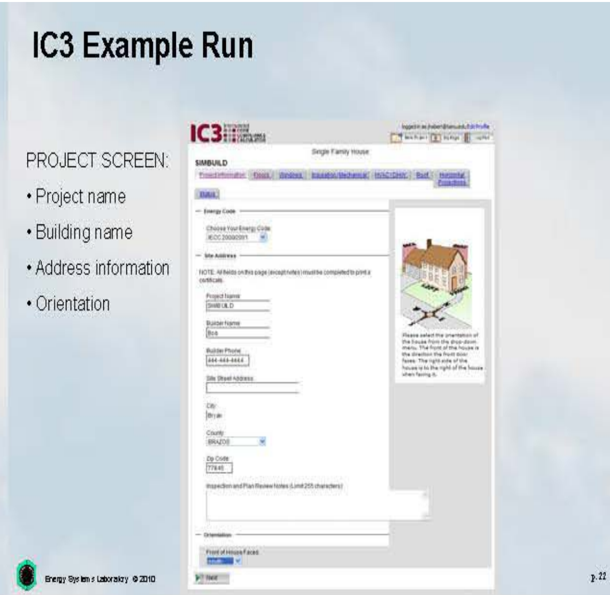
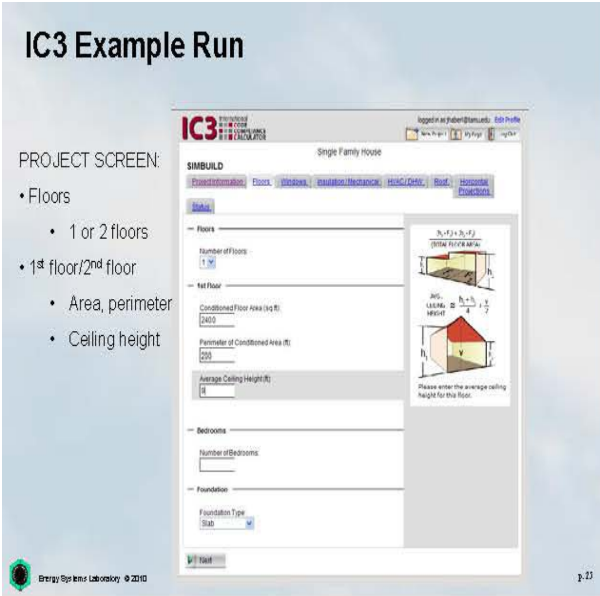
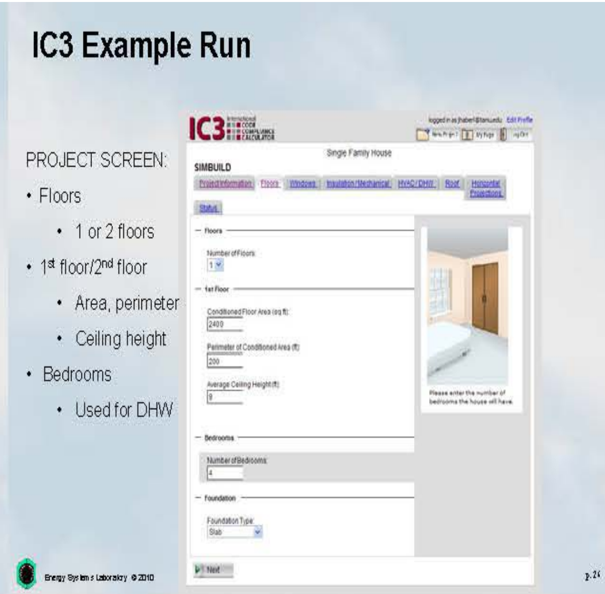


Figure 131: Presentation to SimBuild Conference, New York (August 2010) (Part 6)





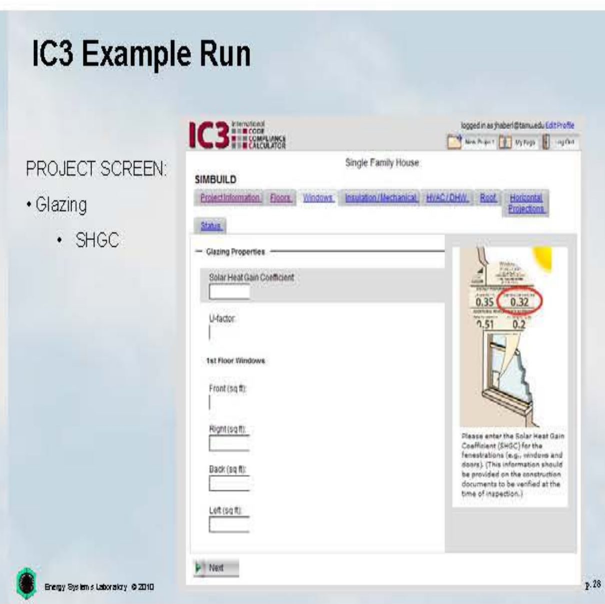
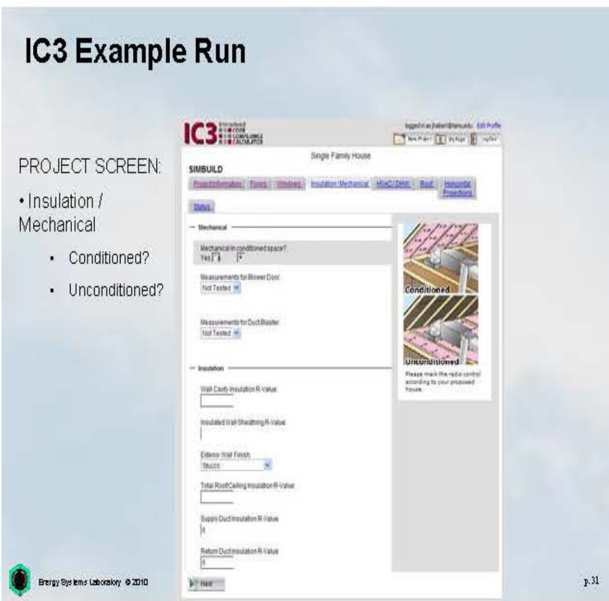


Figure 132: Presentation to SimBuild Conference, New York (August 2010) (Part 7)



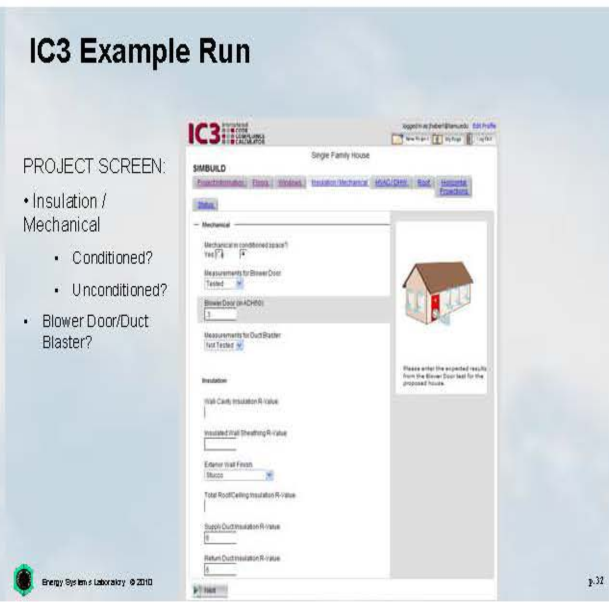
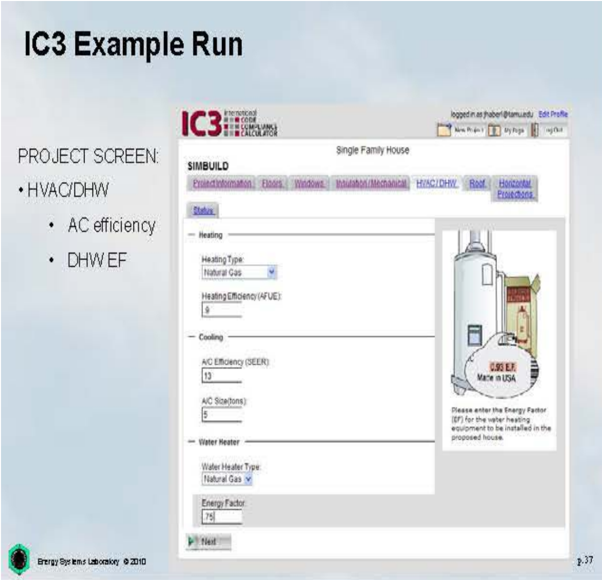


Figure 133: Presentation to SimBuild Conference, New York (August 2010) (Part 8)

Figure 134: Presentation to SimBuild Conference, New York (August 2010) (Part 9)



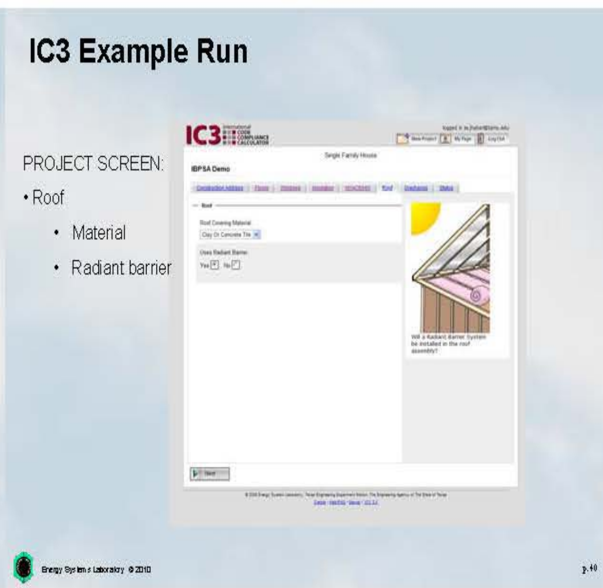
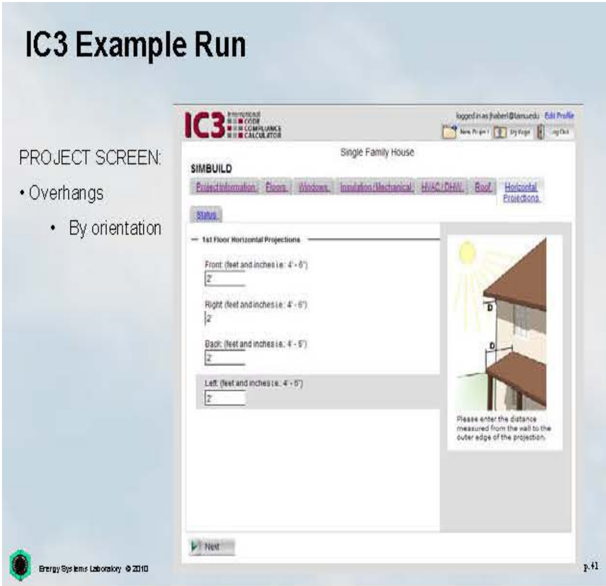
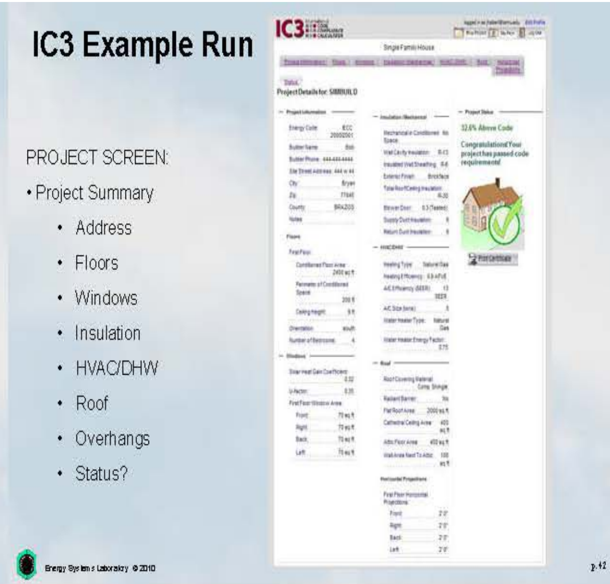
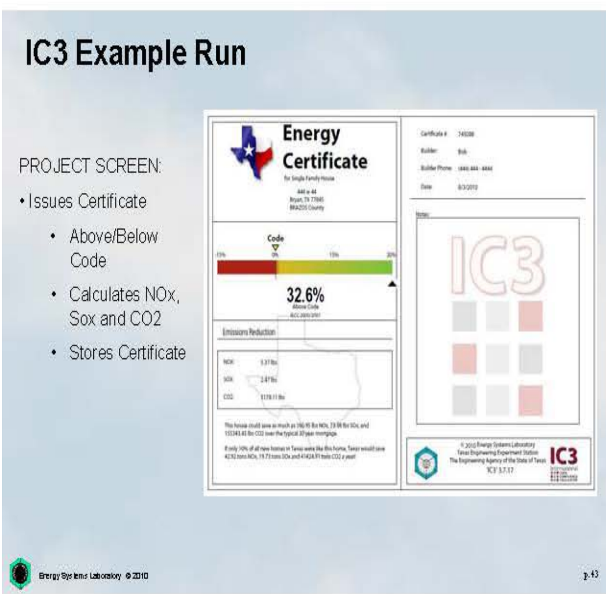


Figure 135: Presentation to SimBuild Conference, New York (August 2010) (Part 10)







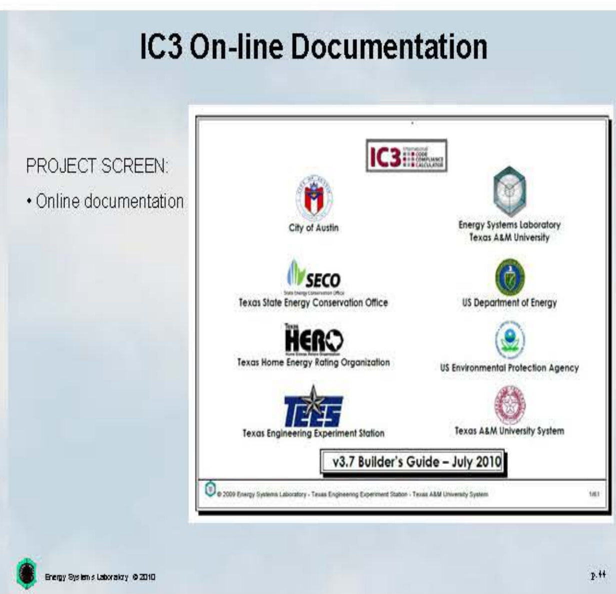
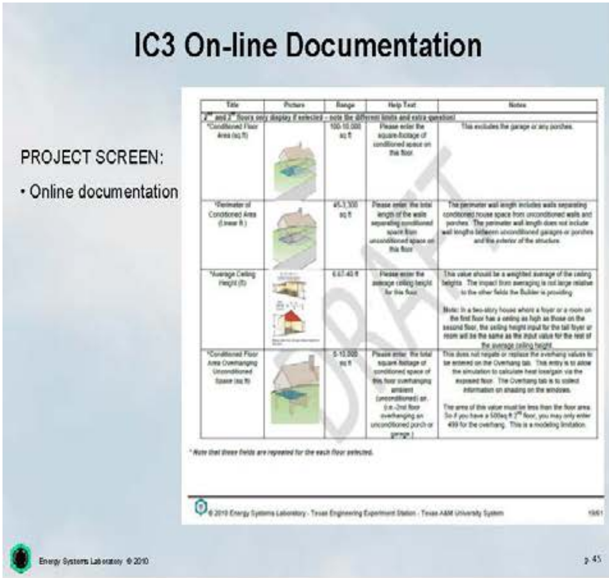
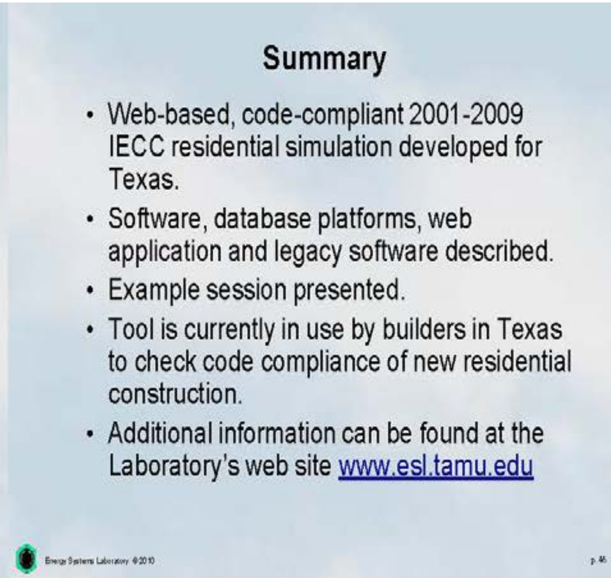


Figure 136: Presentation to SimBuild Conference, New York (August 2010) (Part 11)





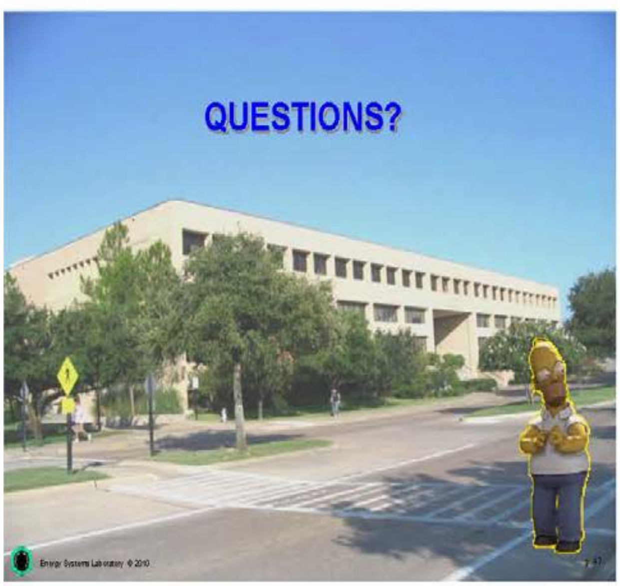
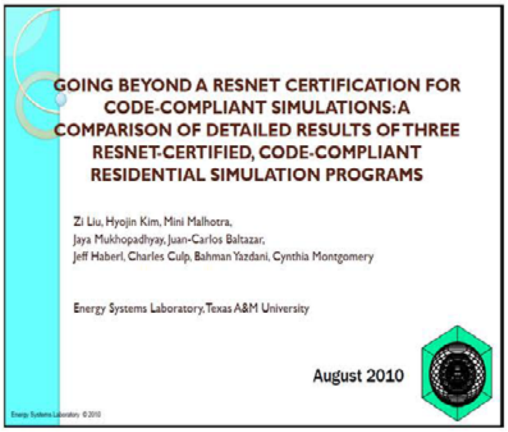
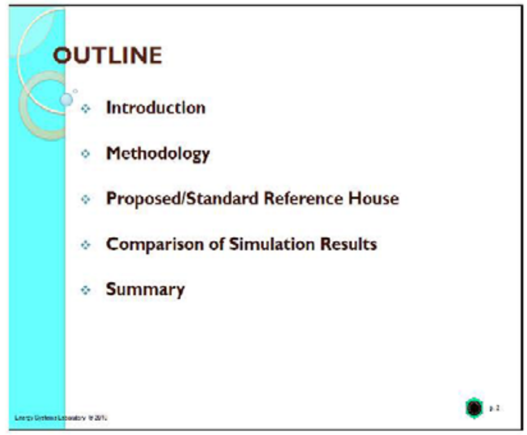
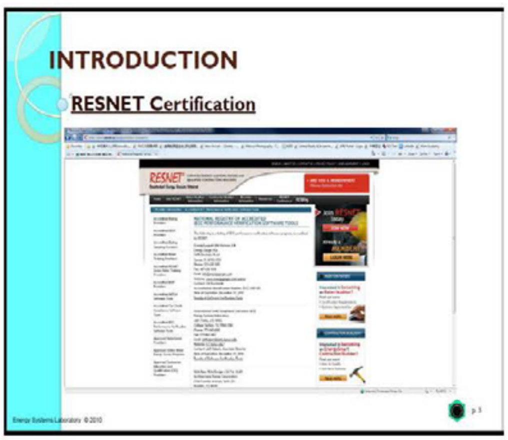


Figure 137: Presentation to SimBuild Conference, New York (August 2010) (Part 12)

The third presentation was a comparison of three RESNET-certified, code-compliant simulation programs.







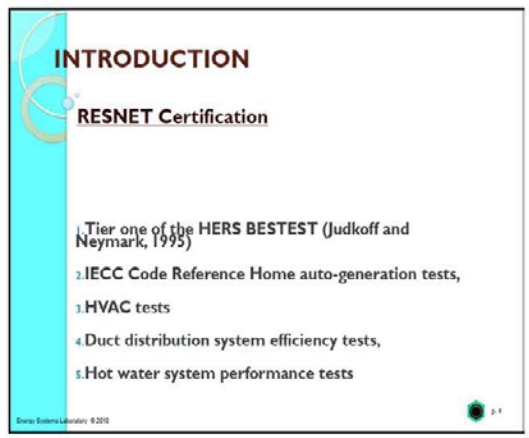
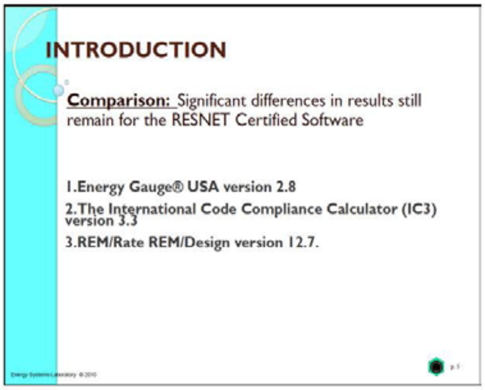
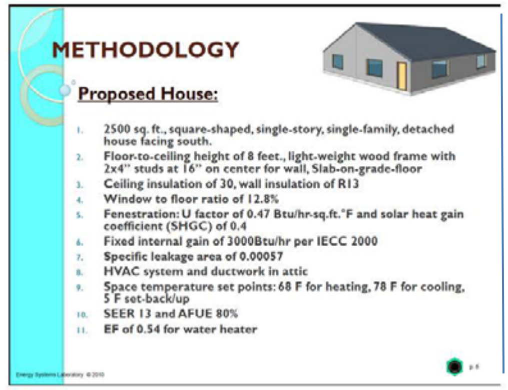
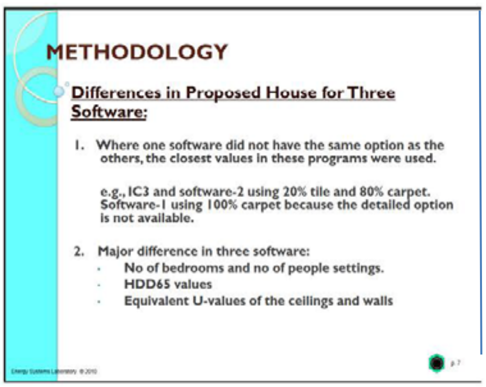


Figure 138: Presentation to SimBuild Conference, New York (August 2010) (Part 1)







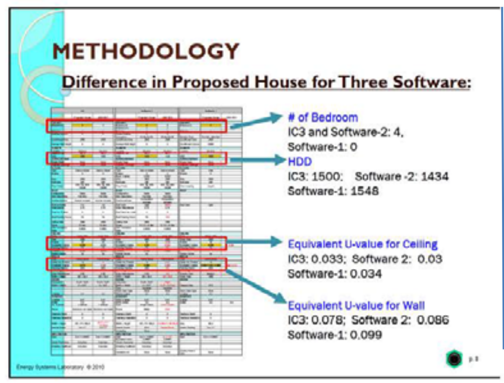
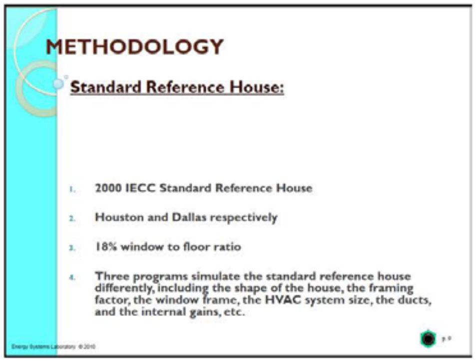
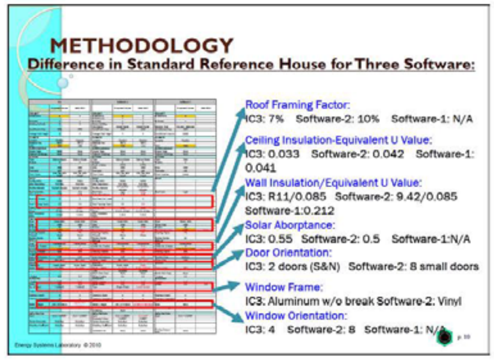
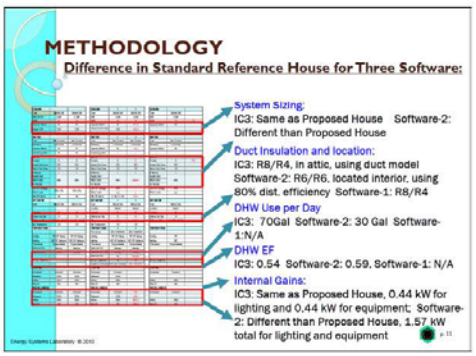


Figure 139: Presentation to SimBuild Conference, New York (August 2010) (Part 2)







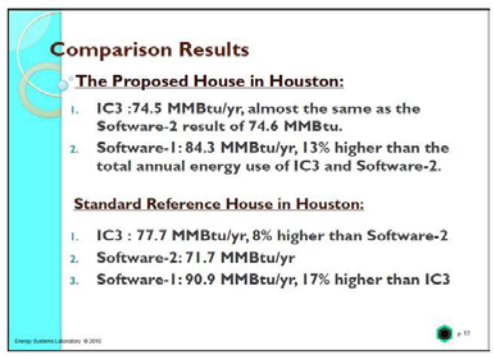
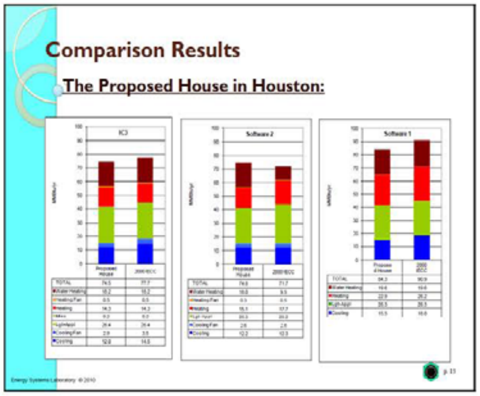
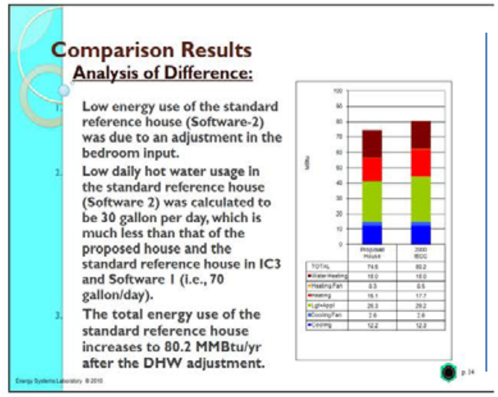
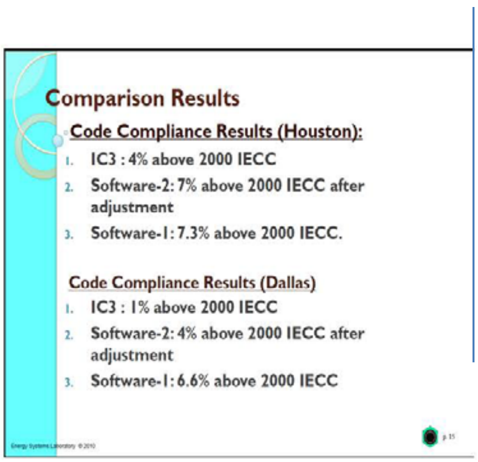


Figure 140: Presentation to SimBuild Conference, New York (August 2010) (Part 3)







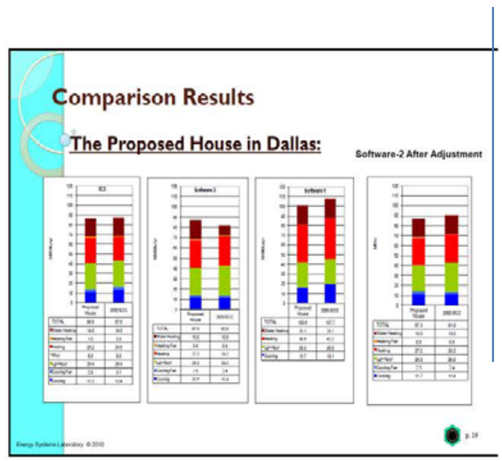
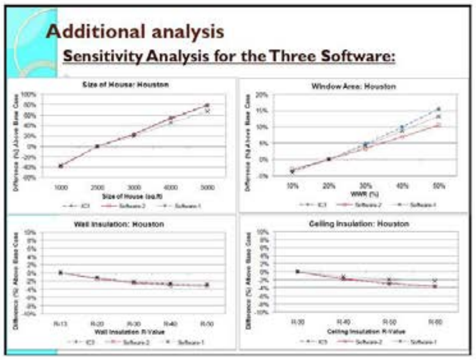
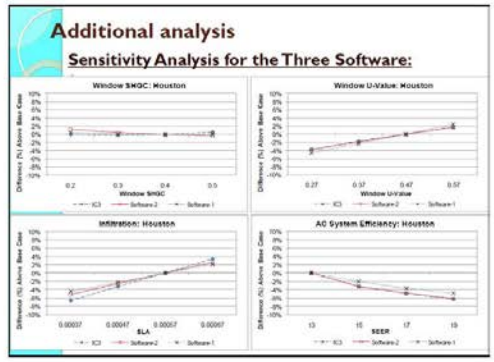
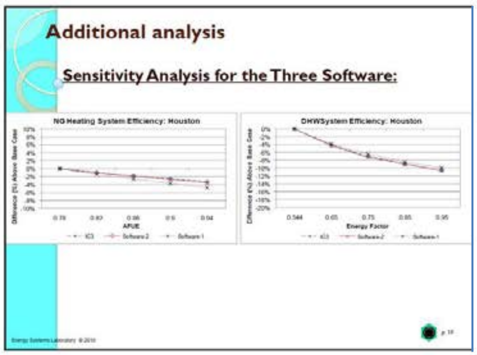


Figure 141: Presentation to SimBuild Conference, New York (August 2010) (Part 4)







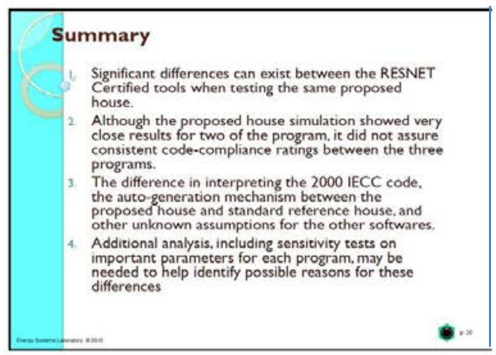


Figure 142: Presentation to SimBuild Conference, New York (August 2010) (Part 5)

5.3.4 Presented four papers at the 2010 ICEBO Conference in Safat, Kuwait, October 2010

Four papers were prepared and presented at the 2010 ICEBO conference in Safat, Kuwait in October 2010. Copies of these papers have been posted on the Laboratory's TERP web page. Titles and abstracts for each of the papers are as follows.

- Kim, S.; Haberl, J. 2010 "Application of an ASHRAE 152-2004 Duct Model for Simulating Code-Compliant 2000/2001 IECC Residences," *Proceedings of the Tenth International Conference for Enhanced Building Operations,* Safat, Kuwait, October 26-28, 2010

This paper traces the results of the application of the duct model based on ASHRAE 152-2004 – Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems (ASHRAE 2004) to the code-compliant 2001 International Energy Conservation Code (IECC) (IECC 1999, 2001) using DOE-2.1e building energy simulation program.

Code compliant DOE-2 simulation model was developed based on IECC and the duct model (Kim and Haberl, 2008) was applied to the IECC-code compliant model. Then, the efficiency analyses of the IECC-compliant simulation model were performed on: 1) duct properties, and 2) the different locations of HVAC system and ductwork including the attic space and conditioned space based on the different climate zones.

- Liu, J.; Baltazar, J-C.; Claridge, D. 2010 "Analysis of the Potential Energy Savings for 14 Office Buildings with VAV Systems", *Proceedings of the Tenth International Conference for Enhanced Building Operations,* Safat, Kuwait, October 26-28, 2010.

At the beginning of an existing building commissioning (EBCx)/energy retrofit project, some form of screening is usually applied to determine whether there is sufficient potential for savings to justify a formal EBCx assessment/energy audit. In this study, an improved methodology for potential energy savings estimation from EBCx/retrofit measures, based on Baltazar's methodology (2006), is proposed to perform this type of screening. The improvements are included on optimization parameters, pace load calculation, simulation of buildings with multiple types of HVAC Systems, AHU shutdown simulation among others.

The improved methodology was used to estimate annual potential energy cost savings for 14 office buildings in Austin, Texas with either single duct VAV (SDVAV) systems or dual duct (DDVAV) systems. The estimates were based on very limited information about the buildings and the built-in HVAC systems as well as one year of uti8lity bills. From this analysis the methodology has predicted an average total potential savings of 36% for SDVAV systems with electric terminal reheat, 22% for SDVAV systems with hot water reset, and 25% for DDVAV systems. To validate these results, the estimated potential savings are compared with savings proposed in respective EBCx assessment reports. Based on the comparison of the report estimates and the potential savings with the improved methodology, it was found that "generalized" factors of assessment predicted energy cost savings to estimated potential energy cost savings could be found. The factors identified in these cases were 0.68, 0.66 and 0.61 for each type of system – SDVAV w/electric reheat, SDVAV w/hot water reheat, and DDVAV respectively.

- Baltazar, J.C., Haberl, J.; Liu, Z.; Mukhopadhyay, J.; Marshall, K.; Gilman, D.; Culp, C.; Yazdani, B.; Lewis, C.; McKelvey, K.; Reid, V. 2010. "A Methodology for Calculating Integrated NOx Emissions Reductions from Energy Efficiency and Renewable Energy (EE/RE) Programs across State Agencies in Texas," *Proceedings of the Tenth International Conference for Enhanced Building Operations,* Safat, Kuwait, October 26-28, 2010.

This paper provides an update of the integrated NOx emissions reductions calculation procedures developed by the Energy Systems Laboratory (ESL) for the State of Texas to satisfy the reporting requirements for Senate Bill 5 of the Texas State Legislature. These procedures are used to report to the Texas Commission on Environmental

Quality (TCEQ) from the state-wide energy efficiency and renewable energy-programs. These programs include: the impact of code-compliant construction, Federal Buildings, furnace pilot light upgrades, the Texas Public Commission (PUC), the energy efficiency programs managed by the Texas State Conservation Office (SECO), electricity generated from wind power in the state and several additional statewide measures, including SEER 13 air conditioner and pilot lights.

- Liu, Z.; Kim, H.; Mukhopadhyay, J.; Baltazar, J-C.; Haberl, J.; Culp, C.; Yazdani, B.; Montgomery, C. 2010. “Going Beyond a RESNET Certification for Code-Compliant Simulations: A Sensitivity Analysis of Detailed Results of Three RESNET-Certified, Code-Compliant Residential Simulation Programs”, *Proceedings of the Tenth International Conference for Enhanced Building Operations*, Safat, Kuwait, October 26-28, 2010.

In many states, building code officials rely on certified, code-compliant simulations to determine whether or not a residence satisfies the energy code requirements using a performance-path analysis. In the United States, certification of residential code-compliant software is performed by the Residential Energy Services Network (RESNET). Unfortunately, significant differences in results can exist when one compares the rating from one certified software program to the next. This paper continues the exploration of some of these differences presented in a previously published paper for an analysis of a code-compliant residence in Texas and presents a sensitivity study using several of these RESNET-certified software in two locations in Texas.

6 Calculated NOx Reduction Potential from Implementation of the 2000 IECC/IRC and ASHRAE Standard 90.1-1999

6.1 Calculated 2010 Electricity and Natural Gas Savings Due to the Implementation of the 2000 IECC/IRC to New Residential Construction (Single-family and Multi-family) and the ASHRAE Standard 90.1-1999 to New Commercial Construction Using Code-traceable, Fuel-Neutral Simulation.

A complete reporting of the savings from the implementation of the 2000 IECC/IRC and the ASHRAE Standard 90.1-1999 require tracking and analyzing savings to new construction and construction activity to existing buildings that undergoes a building permit. Adoption of the 2000 IECC/IRC and the ASHRAE Standard 90.1-1999 are expected to impact the following types of buildings:

- single-family residential
- multi-family residential
- commercial buildings
- industrial buildings
- renewables

The following sections report calculations of the energy savings associated only with new construction activity in new residences (i.e., single-family and multi-family), and commercial construction. Calculation of energy savings adoption of the ASHRAE Standard 90.1-1999 in industrial building and renewables is currently under development at the Laboratory, and will be reported in future reports.

6.1.1 IC3 Enhancements

No.	2009 Annual Report Volume II		Proposed Changes	
1	3.3 Accomplishments since January 2009	Enhanced the IC3 calculator, which is energy code compliance software based on the Texas Building Energy Performance Standards by adding 3-story, multi-family model in the calculator and extending the code to include Houston Amendments and 2009 IECC;		Enhanced the IC3 calculator, which is energy code compliance software based on the Texas Building Energy Performance Standards by resolving minor defects found in the model, introducing new capability to add slab and floor insulation to IC3 interface, and updating manual and illustrations;
2	3.7 Technology for Calculating and Verifying Emissions Reduction from Energy Used in Buildings	-		In 2010, IC3 developments included: • Updated to v3.9 which included enhanced reliability of the models by resolving minor defects, an introduction of new capability to add slab and floor insulation for IC3 users, and better illustrations and updated manual.
3	3.8 Code Adoption, p.80	Many enhancements were added in the development of the International Code Compliance Calculator (IC3). 2009 saw the addition of		Many enhancements were added in the development of the International Code Compliance Calculator (IC3). 2010 saw the enhanced reliability of the models

		three-story, pier and beam, and multifamily. Workshops were developed to train Users in the IC3 software application.		by resolving minor defects and an introduction of new capabilities for the users with better illustrations and updated manual. Workshops were developed to train Users in the IC3 software application.
4	3.10 Planned Focus for 2010	Enhance IC3 to support multifamily residences, and add other features to enhance adoption.		Enhance IC3 to support 2009 IECC code-compliance calculations for both single-family and multi-family with higher reliability, and add other features to enhance adoption.

6.1.2 Changes in single family input file

There have been four major version changes according to the changes in the single family input file since the 2009 annual simulations. Table 4presents the summarized description of the changes in single family input file since the 2009 annual simulation.

Table 4. Changes in single family input file

BDL Version	Description
4.01.04	BDL used for the 2009 annual report
4.01.05	Added a parameter (b17) for above-grade height of multifamily 2nd and 3rd floor units
4.01.06	Removed code for alternate attic infiltration for case of insulation on roof Modified construction for roof and ceiling for a case of insulation on ceiling
4.01.07	Corrected 2009 IECC code for insulation on basement wall and crawlspace for Zone 3 and 4

A. Version 4.01.05

Added a parameter (b17) for above-grade height of multifamily 2nd and 3rd floor units

The first change in the input file was that a new parameter for above-grade height of multifamily 2nd and 3rd floor units (i.e., where the multi-family 2nd floor units are located) was added in the original 2009 input file. One parameter that was blank last year's version, b17 was used to define the above-grade height of multifamily 2nd and 3rd floor units. In the previous version, the 2nd and 3rd floor units were assumed to be located on the ground.

Before applying changes, the impact of different above-grade heights on IC3 results was examined, including energy usage and percentage above code. A series of tests were performed on the city of Houston (Climate Zone: 2) with the three different height options (0 ft for base case, 8 ft for test case 1, and 16 ft for test case 2) for both user house and 2001 IECC code-compliant house. Its impact on energy usage and percentage above code was then analyzed.

A total of three different building configurations (Building A, B, and C) were considered for the base-case model. Each building is a two-storied building consisting of eight units. Four units are arranged on the first floor in sets of two units, which share a common wall. A breezeway is situated between the two sets of units. Four more units are arranged on the second floor in a similar configuration. Table 5 presents a schematic layout of the units arranged by building type. The base-case units are square-shaped and one storied with a floor-to-ceiling height of 8 feet. The floor area of each unit is either 1006 sq. ft. or 1500 sq. ft. The units on the second floor have a vented attic with a roof pitched at 23 degrees.

Table 6 summarizes the total, cooling and heating energy use of each unit and the entire building in MMBtu for three different height options of the 2nd floor units (0 ft for base case, 8 ft for test case 1, and 16 ft for test case 2). Differences in energy usage between base case and test cases were noted as percentage.

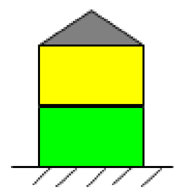
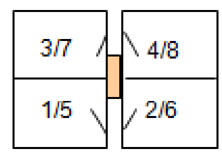
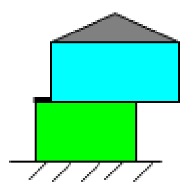
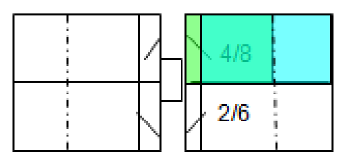
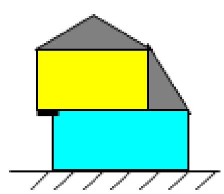
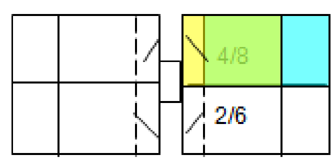
Table 7 lists the percentage above code of each unit and the entire building for three different above-grade height options of the 2nd floor units. Differences in the percentage above code between base case and test cases were also calculated.

As a result, for the test case 1 (8 ft height), the average % difference in percentage above code of the four 2nd floor units ranged from 0.31 % to 0.38 % by building type. For the entire building, the % difference in percentage above code ranged from 0.17 % to 0.19%. For the test case 2 (16 ft height), the average % difference in percentage above code of the four 2nd floor units ranged from 0.52 % to 0.66 % by building type. For the entire building, the % difference in percentage above code ranged from 0.27 % to 0.35%.

Therefore, it would be more accurate to calculate the energy use if the above-grade height where the second or third floor units are located can be provided by the user. As a result, a new parameter was added to the BDL version 4.01.05 of IC3 to be used for this situation.

More details can be found in the Laboratory's follow-up report[19].

Table 5: Schematic Layout of the Units by Building Type

Builidng Type	Unit #	Unit Floor	Building Plan	
A	A-1 A-2 A-3 A-4	1st floor unit		Total of eight units, 4 on first floor and 4 units on second floor 
	A-5 A-6 A-7 A-8	2nd floor unit		
B	B-1 B-2 B-3 B-4	1st floor unit		
	B-5 B-6 B-7 B-8	2nd floor unit		
C	C-1 C-2 C-3 C-4	1st floor unit		
	C-5 C-6 C-7 C-8	2nd floor unit		

[19] Kim, H., Z. Liu, and J.S. Haberl. 2010. Impact of Different Above-Grade Heights of Multi-Family 2nd Floor Units on IC3 Results. ESL-ITR-10-02-02. College Station, TX: Energy Systems Laboratory, Texas A&M University System

Table 6: IC3 Results for Three Different Height Options (0 ft, 8 ft, and 16 ft) of the 2nd Floor Units (User House vs. 2001 IECC Code House)

	Unit #	Energy Use (MMBTU/yr)												% Difference							
		Base case (2nd Floor Unit Height = 0 ft)				Test Case 1 (2nd Floor Unit Height = 8 ft)				Test Case 2 (2nd Floor Unit Height = 16 ft)				Test Case 1 (2nd Floor Unit Height = 8 ft)				Test Case 2 (2nd Floor Unit Height = 16 ft)			
		Unit Total	Unit Cooling	Unit Heating	Building Total	Unit Total	Unit Cooling	Unit Heating	Building Total	Unit Total	Unit Cooling	Unit Heating	Building Total	Unit Total	Unit Cooling	Unit Heating	Building Total	Unit Total	Unit Cooling	Unit Heating	Building Total
User House	A-1	35.1	3.2	1.8	317.1	35.1	3.2	1.8	318.1	35.1	3.2	1.8	318.9				0.32%				0.57%
	A-2	35	3.1	1.8		35	3.1	1.8		35	3.1	1.8									
	A-3	35.6	2.9	2.6		35.6	2.9	2.6		35.6	2.9	2.6									
	A-4	35.4	2.8	2.6		35.4	2.8	2.6		35.4	2.8	2.6									
	A-5	44	7.8	4.7		44.1	7.7	5.1		44.3	7.6	5.3		0.23%	-1.28%	8.51%		0.68%	-2.56%	12.77%	
	A-6	43.6	7.7	4.6		44	7.6	4.9		44.1	7.5	5.1		0.92%	-1.30%	6.52%		1.15%	-2.60%	10.87%	
	A-7	44.4	7.1	5.9		44.6	7	6.3		44.8	7	6.6		0.45%	-1.41%	6.78%		0.90%	-1.41%	11.86%	
	A-8	44	7	5.8		44.3	6.9	6.2		44.6	6.9	6.4		0.68%	-1.43%	6.90%		1.36%	-1.43%	10.34%	
	B-1	35.1	3.2	1.8	344.8	35.1	3.2	1.8	346.8	35.1	3.2	1.8	348.1				0.58%				0.96%
	B-2	35	3.1	1.8		35	3.1	1.8		35	3.1	1.8									
	B-3	35.6	2.9	2.6		35.6	2.9	2.6		35.6	2.9	2.6									
	B-4	35.5	2.8	2.6		35.5	2.8	2.6		35.5	2.8	2.6									
	B-5	50.6	9	9.7		51	8.9	10.3		51.3	8.8	10.7		0.79%	-1.11%	6.19%		1.38%	-2.22%	10.31%	
	B-6	50.2	8.8	9.4		50.7	8.7	10		51	8.6	10.4		1.00%	-1.14%	6.38%		1.59%	-2.27%	10.64%	
	B-7	51.6	8.3	11.6		52.2	8.2	12.2		52.5	8.1	12.6		1.16%	-1.20%	5.17%		1.74%	-2.41%	8.62%	
	B-8	51.2	8.2	11.3		51.7	8.1	12		52.1	8	12.4		0.98%	-1.22%	6.19%		1.76%	-2.44%	9.73%	
	C-1	38.1	3.8	4.1	333.1	38.1	3.8	4.1	334.3	38.1	3.8	4.1	335.1				0.36%				0.60%
	C-2	37.9	3.7	4		37.9	3.7	4		37.9	3.7	4									
	C-3	39.1	3.4	5.4		39.1	3.4	5.4		39.1	3.4	5.4									
	C-4	38.9	3.3	5.3		38.9	3.3	5.3		38.9	3.3	5.3									
	C-5	44.7	7.9	5.3		44.8	7.7	5.7		45	7.7	6		0.22%	-2.53%	7.55%		0.67%	-2.53%	13.21%	
	C-6	44.3	7.8	5.2		44.7	7.6	5.5		44.9	7.5	5.8		0.90%	-2.56%	5.77%		1.35%	-3.85%	11.54%	
	C-7	45.2	7.2	6.6		45.5	7.1	7.1		45.8	7.1	7.4		0.66%	-1.39%	7.58%		1.33%	-1.39%	12.12%	
	C-8	44.9	7.2	6.5		45.3	7.1	6.9		45.4	7	7.2		0.89%	-1.39%	6.15%		1.11%	-2.78%	10.77%	
2001 IECC Code House	A-1	37.1	4.4	4.2	328	37.1	4.4	4.2	329.6	37.1	4.4	4.2	330.8				0.49%				0.85%
	A-2	37.1	4.4	4.2		37.1	4.4	4.2		37.1	4.4	4.2									
	A-3	37.1	4.4	4.2		37.1	4.4	4.2		37.1	4.4	4.2									
	A-4	37.1	4.4	4.2		37.1	4.4	4.2		37.1	4.4	4.2									
	A-5	44.8	8.8	6.3		45.2	8.7	6.8		45.6	8.6	7.1		0.89%	-1.14%	7.94%		1.79%	-2.27%	12.70%	
	A-6	45	8.8	6.3		45.4	8.7	6.8		45.6	8.7	7.2		0.89%	-1.14%	7.94%		1.33%	-1.14%	14.29%	
	A-7	44.8	8.8	6.3		45.2	8.7	6.8		45.6	8.6	7.1		0.89%	-1.14%	7.94%		1.79%	-2.27%	12.70%	
	A-8	45	8.8	6.3		45.4	8.7	6.8		45.6	8.7	7.2		0.89%	-1.14%	7.94%		1.33%	-1.14%	14.29%	
	B-1	37.1	4.4	4.2	360.2	37.1	4.4	4.2	363	37.1	4.4	4.2	365				0.78%				1.33%
	B-2	37.2	4.4	4.2		37.2	4.4	4.2		37.2	4.4	4.2									
	B-3	37.1	4.4	4.2		37.1	4.4	4.2		37.1	4.4	4.2									
	B-4	37.2	4.4	4.2		37.2	4.4	4.2		37.2	4.4	4.2									
	B-5	52.9	11.3	11		53.6	11.2	11.8		54.1	11.2	12.3		1.32%	-0.88%	7.27%		2.27%	-0.88%	11.82%	
	B-6	52.9	11.3	11		53.6	11.3	11.8		54.1	11.2	12.3		1.32%	0.00%	7.27%		2.27%	-0.88%	11.82%	
	B-7	52.9	11.3	11		53.6	11.2	11.8		54.1	11.2	12.3		1.32%	-0.88%	7.27%		2.27%	-0.88%	11.82%	
	B-8	52.9	11.3	11		53.6	11.3	11.8		54.1	11.2	12.3		1.32%	0.00%	7.27%		2.27%	-0.88%	11.82%	
	C-1	41.9	5.9	7	355	41.9	5.9	7	357	41.9	5.9	7	358.4				0.56%				0.96%
	C-2	41.9	6	7		41.9	6	7		41.9	6	7									
	C-3	41.9	5.9	7		41.9	5.9	7		41.9	5.9	7									
	C-4	41.9	6	7		41.9	6	7		41.9	6	7									
	C-5	46.8	9	7.9		47.3	8.9	8.5		47.7	8.8	8.9		1.07%	-1.11%	7.59%		1.92%	-2.22%	12.66%	
	C-6	46.9	9	7.9		47.4	8.9	8.5		47.7	8.9	8.9		1.07%	-1.11%	7.59%		1.71%	-1.11%	12.66%	
	C-7	46.8	9	7.9		47.3	8.9	8.5		47.7	8.8	8.9		1.07%	-1.11%	7.59%		1.92%	-2.22%	12.66%	
	C-8	46.9	9	7.9		47.4	8.9	8.5		47.7	8.9	8.9		1.07%	-1.11%	7.59%		1.71%	-1.11%	12.66%	

Table 7: Percentage Above Code for Three Different Height Options (0 ft, 8 ft, and 16 ft) of the 2nd Floor Units

	Unit #	Energy Use (MMBTU/yr)												% Difference							
		Base case (2nd Floor Unit Height = 0 ft)				Test Case 1 (2nd Floor Unit Height = 8 ft)				Test Case 2 (2nd Floor Unit Height = 16 ft)				Test Case 1 (2nd Floor Unit Height = 8 ft)				Test Case 2 (2nd Floor Unit Height = 16 ft)			
		Unit Total	Unit Cooling	Unit Heating	Building Total	Unit Total	Unit Cooling	Unit Heating	Building Total	Unit Total	Unit Cooling	Unit Heating	Building Total	Unit Total	Unit Cooling	Unit Heating	Building Total	Unit Total	Unit Cooling	Unit Heating	Building Total
% Above Code	A-1	5.4%	27.3%	57.1%	3.3%	5.4%	27.3%	57.1%	3.5%	5.4%	27.3%	57.1%	3.6%				0.17%				0.27%
	A-2	5.7%	29.5%	57.1%		5.7%	29.5%	57.1%		5.7%	29.5%	57.1%									
	A-3	4.0%	34.1%	38.1%		4.0%	34.1%	38.1%		4.0%	34.1%	38.1%									
	A-4	4.6%	36.4%	38.1%		4.6%	36.4%	38.1%		4.6%	36.4%	38.1%									
	A-5	1.8%	11.4%	25.4%		2.4%	11.5%	25.0%		2.9%	11.6%	25.4%		0.65%	0.13%	-0.40%		1.07%	0.26%	-0.04%	
	A-6	3.1%	12.5%	27.0%		3.1%	12.6%	27.9%		3.3%	13.8%	29.2%		-0.03%	0.14%	0.96%		0.18%	1.29%	2.18%	
	A-7	0.9%	19.3%	6.3%		1.3%	19.5%	7.4%		1.8%	18.6%	7.0%		0.43%	0.22%	1.00%		0.86%	-0.71%	0.69%	
	A-8	2.2%	20.5%	7.9%		2.4%	20.7%	8.8%		2.2%	20.7%	11.1%		0.20%	0.24%	0.89%		-0.03%	0.24%	3.17%	
	B-1	5.4%	27.3%	57.1%	4.3%	5.4%	27.3%	57.1%	4.5%	5.4%	27.3%	57.1%	4.6%				0.19%				0.35%
	B-2	5.9%	29.5%	57.1%		5.9%	29.5%	57.1%		5.9%	29.5%	57.1%									
	B-3	4.0%	34.1%	38.1%		4.0%	34.1%	38.1%		4.0%	34.1%	38.1%									
	B-4	4.6%	36.4%	38.1%		4.6%	36.4%	38.1%		4.6%	36.4%	38.1%									
	B-5	4.3%	20.4%	11.8%		4.9%	20.5%	12.7%		5.2%	21.4%	13.0%		0.50%	0.18%	0.89%		0.83%	1.07%	1.19%	
	B-6	5.1%	22.1%	14.5%		5.4%	23.0%	15.3%		5.7%	23.2%	15.4%		0.31%	0.88%	0.71%		0.63%	1.09%	0.90%	
	B-7	2.5%	26.5%	-5.5%		2.6%	26.8%	-3.4%		3.0%	27.7%	-2.4%		0.15%	0.24%	2.06%		0.50%	1.13%	3.02%	
	B-8	3.2%	27.4%	-2.7%		3.5%	28.3%	-1.7%		3.7%	28.6%	-0.8%		0.33%	0.88%	1.03%		0.48%	1.14%	1.91%	
	C-1	9.1%	35.6%	41.4%	6.2%	9.1%	35.6%	41.4%	6.4%	9.1%	35.6%	41.4%	6.5%				0.19%				0.33%
	C-2	9.5%	38.3%	42.9%		9.5%	38.3%	42.9%		9.5%	38.3%	42.9%									
	C-3	6.7%	42.4%	22.9%		6.7%	42.4%	22.9%		6.7%	42.4%	22.9%									
	C-4	7.2%	45.0%	24.3%		7.2%	45.0%	24.3%		7.2%	45.0%	24.3%									
	C-5	4.5%	12.2%	32.9%		5.3%	13.5%	32.9%		5.7%	12.5%	32.6%		0.80%	1.26%	0.03%		1.17%	0.28%	-0.33%	
	C-6	5.5%	13.3%	34.2%		5.7%	14.6%	35.3%		5.9%	15.7%	34.8%		0.15%	1.27%	1.12%		0.33%	2.40%	0.65%	
	C-7	3.4%	20.0%	16.5%		3.8%	20.2%	16.5%		4.0%	19.3%	16.9%		0.39%	0.22%	0.01%		0.56%	-0.68%	0.40%	
	C-8	4.3%	20.0%	17.7%		4.4%	20.2%	18.8%		4.8%	21.3%	19.1%		0.17%	0.22%	1.10%		0.56%	1.35%	1.38%	

B. Version 4.01.06

Removed code for alternate attic infiltration for case of insulation on roof

The change in the input file was to eliminate a conditional statement for attic infiltration which was based on the location of insulation on roof. As a result, the code for a case of insulation on roof was removed, and the code for a case of insulation on ceiling was used for both cases.

[Version 4.01.05]

```
##IF #[P-ROOFRPOS[] EQS C]                    $ WHEN ATTIC INSULATION IS ABOVE CEILING,
M.MALHOTRA, 02/03/2009C

##IF #[#[P-INFMETHOD[] EQS ACH] OR #[P-INFMETHOD[] EQS CSF]]
      INF-METHOD         = AIR-CHANGE          $ DOE-2 DEFAULT=NONE,OR CRACK,AIR-
CHANGE,RESIDENTIAL,S-G
   ##IF #[P-INFMETHOD[] EQS ACH]               $ INFILTRATION METHOD, M.MALHOTRA 05/27/2008
      AIR-CHANGES/HR      = P-ATTINFIL[]        $ M.MALHOTRA, 02/03/2009B
   ##ELSEIF #[P-INFMETHOD[] EQS CSF]
      INF-CFM/SQFT  = #[#[#[ATTICVOL[] / ATTICAREA[]] / 60] * P-ATTINFIL[]]   $ M.MALHOTRA, 02/03/2009B
   ##ENDIF
##ELSEIF #[P-INFMETHOD[] EQS SG]               $ SHERMAN-GRIMSRUD INFILTRATION METHOD,
M.MALHOTRA 07/14/2008
      INF-METHOD         = S-G
      HOR-LEAK-FRAC      = 0.9
      NEUTRAL-LEVEL      = 0.5
      FRAC-LEAK-AREA     = P-ATTICFLA[]
##ENDIF

##ELSEIF #[P-ROOFRPOS[] EQS R]                 $ WHEN ATTIC INSULATION IS UNDERSIDE THE ROOF,
M.MALHOTRA, 02/03/2009C

##IF #[#[P-INFMETHOD[] EQS ACH] OR #[P-INFMETHOD[] EQS CSF]]
      INF-METHOD         = AIR-CHANGE          $ DOE-2 DEFAULT=NONE,OR CRACK,AIR-
CHANGE,RESIDENTIAL,S-G
   ##IF #[P-INFMETHOD[] EQS ACH]               $ INFILTRATION METHOD, M.MALHOTRA 05/27/2008
      AIR-CHANGES/HR      = AIRCHANGE[]        $ ACH=NORMALIZED LEAKAGE(0.57)xWEATHER
FACTOR(FROM ASHRAE STANDARD 136)
   ##ELSEIF #[P-INFMETHOD[] EQS CSF]
      INF-CFM/SQFT       = P-INFCFM/SQFT[]
   ##ENDIF
##ELSEIF #[P-INFMETHOD[] EQS SG]               $ SHERMAN-GRIMSRUD INFILTRATION METHOD,
M.MALHOTRA 07/14/2008
      INF-METHOD         = S-G
      HOR-LEAK-FRAC      = P-HLF[]
      NEUTRAL-LEVEL      = P-NL[]
      FRAC-LEAK-AREA     = P-FLA[]
##ENDIF
```

[Version 4.01.06]

```
##IF #[#[P-INFMETHOD[] EQS ACH] OR #[P-INFMETHOD[] EQS CSF]]
      INF-METHOD         = AIR-CHANGE          $ DOE-2 DEFAULT=NONE,OR CRACK,AIR-
CHANGE,RESIDENTIAL,S-G
   ##IF #[P-INFMETHOD[] EQS ACH]               $ INFILTRATION METHOD, M.MALHOTRA 05/27/2008
      AIR-CHANGES/HR      = P-ATTINFIL[]        $ M.MALHOTRA, 02/03/2009B
   ##ELSEIF #[P-INFMETHOD[] EQS CSF]
      INF-CFM/SQFT  = #[#[#[ATTICVOL[] / ATTICAREA[]] / 60] * P-ATTINFIL[]]   $ M.MALHOTRA, 02/03/2009B
   ##ENDIF
##ELSEIF #[P-INFMETHOD[] EQS SG]               $ SHERMAN-GRIMSRUD INFILTRATION METHOD,
M.MALHOTRA 07/14/2008
      INF-METHOD         = S-G
      HOR-LEAK-FRAC      = 0.9
```

```
      NEUTRAL-LEVEL       = 0.5
      FRAC-LEAK-AREA      = P-ATTICFLA[]          $ REMOVED CONDITIONS FOR ATTIC INFILTRATION, JAYA M.
01/21/2010
##ENDIF
```

<u>*Modified construction for roof and ceiling for a case of insulation on ceiling*</u>

The change in the input file was to modify glitch in code for a case of insulation on ceiling.

[Version 4.01.05]

```
CLA_2       = LAYERS
         INSIDE-FILM-RES = 0.765
         MATERIAL = (BATT-ACEIL,ROOF_STUD,GP01) ..
```

[Version 4.01.06]

```
CLA_2       = LAYERS
         INSIDE-FILM-RES = 0.765
   ##IF #[#[P-ROOFRPOS[] EQS C] AND #[P-CEILR[] GE 0.1]]
   MATERIAL = (BATT-ACEIL,ROOF_STUD,GP01) ..
   ##ELSEIF #[P-CEILR[] LT 0.1]              $ 02/20/2009E, M.MALHOTRA
   MATERIAL = (BATT-ACEIL,ROOF_STUD,GP02) ..
   ##ELSEIF #[P-ROOFRPOS[] EQS R]            $ 01/21/2010, JAYA M. CORRECTED TO ACCOMODATE CASE OF INS
ON ROOF
   MATERIAL = (ROOF_STUD,GP02) ..
   ##ENDIF
```

C. Version 4.01.07

Modified 2009 IECC code for insulation on basement wall and crawlspace for Zone 3 and 4

The change in the input file was to add specifications for 2009 IECC code-compliant house in warm-humid locations of Zone 3 and to modify basement and crawlspace insulation requirements for 2009 IECC code-compliant house in Zone 4.

[Version 4.01.06]

```
##ELSEIF #[CZ[] EQS 3]
   ##SET1 P-WINDOWU       0.50
   ##SET1 P-SHGF          0.3
   ##SET1 P-CEILR         27.84
   ##SET1 P-WALLR         11.8
   ##SET1 WALLEXT-R       0
   ##SET1 P-FLOORR        19
   ##SET1 P-BSWALLR       5
   ##SET1 P-SLABR         0
   ##SET1 P-CRWALLR       5
   ##SET1 WALL-U          0.082
   ##SET1 P-STUD          3.5

##ELSEIF #[CZ[] EQS 4]
   ##SET1 P-WINDOWU       0.35
   ##SET1 P-SHGF          0.4
   ##SET1 P-CEILR         32.51
   ##SET1 P-WALLR         11.8
   ##SET1 WALLEXT-R       0
   ##SET1 P-FLOORR        19
   ##SET1 P-BSWALLR       0
   ##SET1 P-SLABR         10
   ##SET1 P-CRWALLR       0
   ##SET1 WALL-U          0.082
   ##SET1 P-STUD          3.5
```

[Version 4.01.07]

```
##ELSEIF #[CZ[] EQS 3*]
   ##SET1 P-WINDOWU       0.50
   ##SET1 P-SHGF          0.3
   ##SET1 P-CEILR         27.84
   ##SET1 P-WALLR         11.8
   ##SET1 WALLEXT-R       0
   ##SET1 P-FLOORR        19
   ##SET1 P-SLABR         0
   ##SET1 WALL-U          0.082
   ##SET1 P-STUD          3.5
   ##SET1 P-BSWALLR       0
   ##SET1 P-CRWALLR       0

##ELSEIF #[CZ[] EQS 3]
   ##SET1 P-WINDOWU       0.50
   ##SET1 P-SHGF          0.3
   ##SET1 P-CEILR         27.84
   ##SET1 P-WALLR         11.8
   ##SET1 WALLEXT-R       0
   ##SET1 P-FLOORR        19
   ##SET1 P-SLABR         0
   ##SET1 WALL-U          0.082
   ##SET1 P-STUD          3.5
   ##SET1 P-BSWALLR       5
   ##SET1 P-CRWALLR       5

##ELSEIF #[CZ[] EQS 4]
   ##SET1 P-WINDOWU       0.35
```

```
##SET1 P-SHGF          0.4
##SET1 P-CEILR        32.51
##SET1 P-WALLR         11.8
##SET1 WALLEXT-R       0
##SET1 P-FLOORR        19
##SET1 P-BSWALLR       10
##SET1 P-SLABR        10
##SET1 P-CRWALLR       10
##SET1 WALL-U         0.082
##SET1 P-STUD         3.5
```

6.1.3 2010 Results for New Single-family Residential Construction

In this section of the report, calculations are provided regarding the potential electricity reductions and associated emissions reductions from the implementation of the 2000 IECC/IRC to new single-family residences in the 41 non-attainment and affected counties as well as other counties in the ERCOT region[20]. To calculate the NOx emissions reductions from the implementation of the 2000 IECC/IRC, a number of procedures were followed. First, new construction activity by county had to be determined, then energy savings attributable to the 2000 IECC/IRC had to be modeled using the code-traceable, DOE-2 simulation that the Laboratory has developed for the TERP. These estimates were then applied to the NAHB Builder's survey data to determine the appropriate number of housing types. Then estimates of the NOx reduction potential from the electricity reductions in each county were calculated using the US EPA's 2007 eGRID database[21].

In Table 8 and Table 9, the 1999 and the 2000 IECC/IRC code-compliant building characteristics are shown for each county. The 1999 building characteristics reflect those published by the NAHB, ARI and GAMA for Texas. The 2000 IECC/IRC code-compliant characteristics are the minimum building code characteristics required by the 2000 IECC/IRC for each county for single-family residences (i.e., Type A.1)[22]. In Table 10 and Table 11, the rows are sorted first by the US EPA's non-attainment, affected designation, and other ERCOT Counties, then alphabetically. Next, in the fourth column, the NAHB survey classification is listed. The fifth column in Table 8 and Table 9 lists the window area for the average house as defined by the NAHB survey[23].

[20]The three new counties, Henderson, Hood and Hunt were added in the 2003 Legislative session are included in this.
[21] This preliminary analysis does not include actual power transfers on the grid, and assumes transmission and distribution losses of 7%. Counties were assigned to utility service districts as indicated.
[22] As modified by the 2001 Supplement.
[23] This value represents the NAHB's reported number of window units times an average window size of 3 x 5 feet, which was determined by surveying local building suppliers. Additional information about the procedures used to determine these values can be found in the MS Thesis by Im (2003).

The sixth, seventh, eighth, and ninth columns show the NAHB's average glazing U-value, Solar Heat Gain Coefficient (SHGC), roof insulation and wall insulation, respectively. In columns ten through fourteen of Table 10 and Table 11, the corresponding values from the 2000 IECC / IRC code-compliant house are listed for each county (i.e., percent area, glazing U-value, SHGC, roof and wall insulation R-value). For each county, the identical window percent area was used for the 1999 and code-compliant calculation (i.e., window-to-wall area).

The 2000 IECC/IRC SHGC is 0.4 for all non-attainment and affected counties since they all fall below the 3,500 HDD_{65}, as required by the 2000 IECC/IRC. All the 1999 houses were assumed to have an air-conditioner efficiency[24] equal to a SEER 11, a furnace efficiency (AFUE) of 0.80, and a domestic water heater efficiency of 76%. All the 2000 IECC/IRC code-compliant houses were assumed to have an air-conditioner efficiency equal to a SEER 13[25]. The values shown in Table 10 and Table 11represent the only changes that were made to the simulation to obtain the savings calculations. All other variables in the simulation remained the same for the 1999 and the 2000 IECC/IRC code-compliant simulation. In cases where the 1999 values were more efficient than the 2000 IECC/IRC code-compliant simulation, the 1999 values were used in both simulations, since this indicates that the prevailing practice is already above code. For example, in Brazoria County, according to the NAHB, the roof insulation is R-27.08, which is already above the code-required insulation of R-19. Therefore, R-27.08 was used in both simulations.

The code-traceable simulation results are shown for each county. In a similar fashion as Table 8 and Table 9, Table 10 and Table 11 are first divided into US EPA affected and then non-attainment classifications, followed by an alphabetical listing of counties. In the third column of Table 10 and Table 11, the 2000 IECC/IRC climate zone is listed followed by the number of projected new housing units[26] in the fourth column. In the fifth column, the total simulated energy use is listed if all new construction had been built to pre-code specifications, and, in the sixth column, the total county-wide energy use for code-compliant construction is shown. The values in the fifth and sixth columns come from the associated tables in the 2010 Volume III Appendix, which remain the same as the 2009 listing, 24 simulations were run for each county, which were then distributed according to the NAHB's survey data to account for 1 story, 2 story, slab-on-grade, crawlspace, and three different system types. In the seventh and eighth columns, the total pre-code and code-compliant peak OSD energy use is reported for the Ozone Season Day across all counties[27]. In a similar fashion as the annual pre-code and code-compliant energy use, these values are from the associated tables for each county in the Volume III Appendix to this report for the 2010 peak OSD results. In the ninth and tenth columns, the total annual electricity and peak OSD savings are shown for each county, respectively. A 7% transmission and distribution loss is used in the 2010 report, which represents a fixed 1.07 multiplier for the electricity use. In the eleventh and twelfth columns, the total annual pre-code and code-compliant natural gas use is shown for those residences that had natural gas-fired furnaces and domestic water heaters. Similarly, in columns thirteen and fourteen, the simulated total peak OSD natural gas use on the peak Ozone Season Day (OSD) is shown for each county. Finally, in columns fifteen and sixteen, the total annual and peak OSD natural gas savings are shown for each county.

In Table 12 and Table 13, the PCA assignments for each county are shown. These assignments are the same as the ones used in the 2006 annual report. These assignments were expanded from the 2005 report because all ERCOT counties are shown in the 2006 report. In Table 14, the annual electricity savings are assigned to PCA provider(s) according to Table 12 and Table 13. The total electricity savings for each PCA, as shown in Table 15 then entered into the bottom row of Table 14 and Table 16, which is the 2007 US EPA eGRID database for Texas. eGRID then proportions each MWh of electricity savings according to the 1999 measured data from the power plants assigned to that PCA. For each county in which there is a power plant the lbs-NOx/MWh are calculated and displayed as NOx reductions (lbs) in the column adjacent to the PCA column. Adding across the rows then totals the NOx reductions in each county from multiple PCAs that have power plants in that county. Counties that do not show NOx reductions represent counties that do not have power plants in eGRID's database. In Table 16 the PCA assignments for peak reductions are shown for each county; and in Table 17 the peak OSD NOx reductions are shown calculated with eGRID.

[24] The choice of a SEER 11 efficiency for the air conditioner was based on ARI sales numbers for Texas which show an average SEER 11 for houses built in 1999.
[25] Based on the regulation effective.
[26] The number of projected new housing units uses the published values for the new housing units in 2010. A vacancy rate of 0% was assumed for 2010 calculations, based on information suggested by the Real Estate Center at Texas A&M University.
[27] In the 2005 report, the peak Ozone Season Day (OSD) was used to report peak savings. This is different than the peak day for 2004, which was August 19, 1999. This change was made at the request of the TCEQ. In the 2002 and 2003 reports, these dates represent the TMY2 non-coincident dates that were chosen by the DOE-2 simulation program as the peak date for the houses simulated in a specific county. Hence, the 2002 and 2003 dates did not correspond to the same calendar date.

Table 8: 1999 and the 2000 IECC/IRC Code-compliant Building Characteristics used in the DOE-2 Simulator for Single-family Residential (1)

	County	Climate Zone	Division (East or West)	1999 Average Area %	1999 Average Glazing U-value (Btu/ hr-ft2-F)	1999 Average SHGC	1999 Average Roof Insulation (hr-ft2-F/Btu)	1999 Average Wall Insulation (hr-ft2-F/Btu)	2000 IECC Area %	2000 IECC Glazing U-value (Btu/ hr-ft2-F)	2000 IECC SHGC	2000 IECC Roof Insulation (hr-ft2-F/Btu)	2000 IECC Wall Insulation (hr-ft2-F/Btu)
Non-attainment	BRAZORIA	3	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	19.00	11.00
	CHAMBERS	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	COLLIN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	DALLAS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	DENTON	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	EL PASO	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FORT BEND	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	GALVESTON	3	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	19.00	11.00
	HARDIN	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	HARRIS	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	JEFFERSON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	LIBERTY	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	MONTGOMERY	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	ORANGE	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	TARRANT	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	WALLER	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
Affected	BASTROP	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	BEXAR	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	CALDWELL	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	COMAL	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	ELLIS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	GREGG	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	GUADALUPE	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	HARRISON	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	HAYS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	HENDERSON	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	HOOD	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	HUNT	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	JOHNSON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	KAUFMAN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	NUECES	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	PARKER	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	ROCKWALL	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	RUSK	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	SAN PATRICIO	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	SMITH	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	TRAVIS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	UPSHUR	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	VICTORIA	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	WILLIAMSON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	WILSON	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
ERCOT	ANDERSON	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	ANDREWS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	ANGELINA	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	ARANSAS	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	ARCHER	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	ATASCOSA	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	AUSTIN	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	BANDERA	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BAYLOR	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	BEE	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	BELL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BLANCO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BORDEN	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	BOSQUE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BRAZOS	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	BREWSTER	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BRISCOE	8	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.41	0.40	38.00	19.00
	BROOKS	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	BROWN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	BURLESON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	BURNET	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	CALHOUN	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	CALLAHAN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	CAMERON	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	CHEROKEE	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	CHILDRESS	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	CLAY	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	COKE	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	COLEMAN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	COLORADO	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	COMANCHE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	CONCHO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	COOKE	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	CORYELL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	COTTLE	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	CRANE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	CROCKETT	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	CROSBY	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	CULBERSON	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	DAWSON	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	DE WITT	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	DELTA	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	DICKENS	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	DIMMIT	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	DUVAL	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	EASTLAND	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	ECTOR	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	EDWARDS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	ERATH	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FALLS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	FANNIN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FAYETTE	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	FISHER	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FOARD	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	FRANKLIN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	FREESTONE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00

Table 9: 1999 and the 2000 IECC/IRC Code-compliant Building Characteristics used in the DOE-2 Simulator for Single-family Residential (2)

	County	Climate Zone	Division	1999 Average					2000 IECC				
			(East or West)	Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)	Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)
	FRIO	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	GILLESPIE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	GLASSCOCK	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	GOLIAD	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	GONZALES	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	GRAYSON	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	GRIMES	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	HALL	8	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.41	0.40	38.00	19.00
	HAMILTON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	HARDEMAN	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	HASKELL	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	HIDALGO	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	HILL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	HOPKINS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	HOUSTON	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	HOWARD	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	HUDSPETH	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	IRION	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	JACK	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	JACKSON	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	JEFF DAVIS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	JIM HOGG	2	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	JIM WELLS	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	JONES	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	KARNES	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	KENDALL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	KENEDY	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	KENT	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	KERR	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	KIMBLE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	KING	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	KINNEY	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	KLEBERG	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	KNOX	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	LA SALLE	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	LAMAR	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	LAMPASAS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	LAVACA	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	LEE	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	LEON	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	LIMESTONE	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	LIVE OAK	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	LLANO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	LOVING	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MADISON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	MARTIN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MASON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MATAGORDA	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	MAVERICK	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	MCCULLOCH	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MCLENNAN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MCMULLEN	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
ERCOT	MEDINA	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	MENARD	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MIDLAND	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MILAM	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	MILLS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	MITCHELL	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MONTAGUE	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	MOTLEY	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	NACOGDOCHES	5	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.65	0.40	30.00	13.00
	NAVARRO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	NOLAN	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	PALO PINTO	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	PECOS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	PRESIDIO	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	RAINS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	REAGAN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	REAL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	RED RIVER	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	REEVES	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	REFUGIO	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	ROBERTSON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	RUNNELS	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	SAN SABA	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	SCHLEICHER	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	SCURRY	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	SHACKELFORD	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	SOMERVELL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	STARR	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	STEPHENS	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	STERLING	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	STONEWALL	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	SUTTON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	TAYLOR	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	TERRELL	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	THROCKMORTON	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	TITUS	6	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	TOM GREEN	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	UPTON	5	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.50	0.40	38.00	13.00
	UVALDE	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	VAL VERDE	4	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.52	0.40	30.00	13.00
	VAN ZANDT	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	WARD	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	WASHINGTON	4	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.75	0.40	26.00	13.00
	WEBB	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	WHARTON	3	East Texas	13.8	1.11	0.71	27.08	14.18	13.8	0.75	0.40	19.00	11.00
	WICHITA	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	WILBARGER	7	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.45	0.40	38.00	19.00
	WILLACY	2	East Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.90	0.40	19.00	11.00
	WINKLER	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	WISE	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	YOUNG	6	West Texas	20.6	0.87	0.66	26.75	14.18	20.6	0.46	0.40	38.00	16.00
	ZAPATA	2	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00
	ZAVALA	3	West Texas	13.8	1.11	0.71	27.08	13.99	13.8	0.60	0.40	30.00	13.00

Table 10: 2010 Annual and Peak-day Electricity Savings from Implementation of the 2000 IECC / IRC for Single-family Residences Using 1999 Base Year (1)

2010 Summary TRY 1999

	County	Climate Zone	No. of Projected Units (2010)	Precode Total Annual Elec. Use (MWh/yr)	Code-compliant Total Annual Elec. Use (MWh/yr)	Precode OSD Elec. Use (MWh/day)	Code-compliant OSD Elec. Use (MWh/day)	Total Annual Elec. Savings (MWh/yr) w/ 7% of T&D Loss	Total OSD Elec. Savings (MWh/day) w/ 7% of T&D Loss	Precode Total NG Use (Therm/yr)	Code-compliant Total NG Use (Therm/yr)	Precode OSD NG Use (Therm/day)	Code-compliant OSD NG Use (Therm/day)	Total Annual NG Savings (Therm/yr)	Total OSD NG Savings (Therm/day)
Affected County	BASTROP	4	31	492	436	2.03	1.69	59	0.37	3,669	3,416	6.74	6.41	254	0.33
	BEXAR	4	3,151	50,015	44,957	194.13	164.35	5,412	31.86	299,598	275,583	515.38	490.88	24,015	24.50
	CALDWELL	4	10	164	146	0.67	0.56	19	0.12	872	812	1.60	1.52	60	0.08
	COMAL	4	846	13,428	12,070	52.12	44.13	1,453	8.56	80,438	73,990	138.37	131.79	6,448	6.58
	ELLIS	5	487	8,532	7,618	33.80	28.17	977	6.02	62,821	57,840	75.86	72.07	4,981	3.79
	GREGG	6	198	3,261	2,868	13.18	10.81	420	2.54	33,741	28,628	41.89	39.79	5,113	2.09
	GUADALUPE	4	868	13,777	12,384	53.48	45.27	1,491	8.78	82,530	75,914	141.97	135.22	6,615	6.75
	HARRISON	6	36	591	521	2.38	1.95	76	0.45	6,198	5,253	7.62	7.24	945	0.38
	HAYS	5	1,130	18,545	16,493	75.29	62.85	2,196	13.32	98,481	91,701	180.86	172.07	6,780	8.79
	HENDERSON	5	60	984	872	3.95	3.27	120	0.73	10,383	8,945	12.69	12.06	1,439	0.63
	HOOD	5	77	1,349	1,205	5.34	4.45	155	0.95	9,933	9,145	11.99	11.40	788	0.60
	HUNT	6	37	649	576	2.57	2.12	79	0.47	4,785	4,332	5.76	5.48	453	0.29
	JOHNSON	5	437	7,656	6,836	30.33	25.28	877	5.40	56,371	51,902	68.07	64.67	4,470	3.40
	KAUFMAN	6	187	3,283	2,914	13.00	10.78	394	2.38	24,123	21,565	29.13	27.68	2,558	1.45
	NUECES	3	699	11,220	9,858	42.80	35.97	1,457	7.32	75,211	68,860	156.18	148.80	6,352	7.38
	PARKER	6	144	2,528	2,244	10.01	8.30	304	1.83	18,576	16,606	22.43	21.31	1,970	1.12
	ROCKWALL	6	489	8,585	7,621	34.00	28.20	1,031	6.21	63,080	56,391	76.17	72.37	6,689	3.80
	RUSK	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SAN PATRICIO	3	126	2,022	1,777	7.72	6.48	263	1.32	13,557	12,412	28.15	26.82	1,145	1.33
	SMITH	5	201	3,296	2,916	13.23	10.92	407	2.47	34,783	30,538	42.52	40.40	4,246	2.12
	TRAVIS	5	3,140	51,533	45,831	209.22	174.64	6,101	37.00	273,654	254,815	502.56	478.14	18,839	24.42
	UPSHUR	6	15	252	224	1.03	0.85	30	0.19	2,645	2,324	3.17	3.01	321	0.16
	VICTORIA	3	47	702	628	2.72	2.29	80	0.46	5,867	5,266	10.76	10.26	600	0.50
	WILLIAMSON	5	1,889	31,002	27,571	125.87	105.06	3,671	22.26	164,628	153,295	302.34	287.65	11,334	14.69
	WILSON	4	31	492	442	1.91	1.62	53	0.31	2,947	2,711	5.07	4.83	236	0.24
Nonattain-ment County	BRAZORIA	3	1,647	25,485	22,476	100.89	83.88	3,220	18.20	194,265	176,111	362.68	345.29	18,154	17.39
	CHAMBERS	4	226	3,500	3,083	13.75	11.42	445	2.49	26,882	24,421	50.67	48.28	2,460	2.39
	COLLIN	6	4,171	73,225	64,910	290.03	239.92	8,897	53.62	538,052	486,986	649.72	617.29	51,066	32.43
	DALLAS	5	2,742	48,038	42,894	190.30	158.62	5,504	33.89	353,706	325,661	427.13	405.80	28,045	21.32
	DENTON	6	2,568	45,083	40,022	178.57	148.08	5,415	32.62	331,268	296,138	400.02	380.05	35,130	19.97
	EL PASO	6	2,961	48,529	43,278	158.82	136.58	5,618	23.80	362,975	324,034	502.02	478.99	38,941	23.02
	FORT BEND	4	4,724	73,143	64,493	289.67	240.76	9,256	52.33	557,150	503,620	1,040.25	990.37	53,530	49.89
	GALVESTON	3	1,731	26,785	23,622	106.04	88.16	3,384	19.13	204,173	185,093	381.18	362.90	19,080	18.28
	HARDIN	4	87	1,348	1,188	5.30	4.40	172	0.96	10,348	9,401	19.50	18.59	947	0.92
	HARRIS	4	11,057	171,198	150,951	678	564	21,664	122.48	1,304,067	1,178,774	2,434.82	2,318.05	125,293	116.76
	JEFFERSON	4	959	14,869	13,095	58	49	1,899	10.59	114,068	103,629	215.00	204.87	10,439	10.13
	LIBERTY	4	193	2,991	2,636	12	10	380	2.14	22,762	20,576	42.50	40.46	2,187	2.04
	MONTGOMERY	4	2,723	42,161	37,175	166.97	138.78	5,335	30.16	321,152	290,296	599.62	570.87	30,856	28.75
	ORANGE	4	210	3,256	2,867	13	11	416	2.32	24,978	22,693	47.08	44.86	2,286	2.22
	TARRANT	5	4,203	73,633	65,749	292	243	8,436	51.95	542,169	499,181	654.71	622.02	42,988	32.68
	WALLER	4	9	139	123	0.55	0.46	18	0.10	1,061	959	1.98	1.89	102	0.10
ERCOT	ANDERSON	5	16	244	218	0.91	0.77	28	0.16	2,727	2,414	3.70	3.53	312	0.17
	ANDREWS	6	31	555	495	1.64	1.41	65	0.25	5,390	4,805	5.47	5.23	585	0.24
	ANGELINA	5	43	656	587	2.45	2.06	74	0.42	7,328	6,489	9.95	9.49	839	0.45
	ARANSAS	3	100	1,605	1,410	6.12	5.15	208	1.05	10,760	9,851	22.34	21.29	909	1.06
	ARCHER	7	12	245	216	0.79	0.66	32	0.14	2,548	2,254	2.01	1.92	294	0.09
	ATASCOSA	3	34	538	484	2.09	1.77	58	0.34	3,229	2,969	5.56	5.30	260	0.26
	AUSTIN	4	18	279	246	1.10	0.92	35	0.20	2,123	1,919	3.96	3.77	204	0.19
	BANDERA	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	BAYLOR	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	BEE	3	9	134	120	0.52	0.44	15	0.09	1,123	1,008	2.06	1.96	115	0.10
	BELL	5	1,750	31,473	28,001	118.10	98.21	3,715	21.29	255,053	235,695	296.51	282.90	19,358	13.61
	BLANCO	5	5	82	73	0.33	0.28	10	0.06	436	406	0.80	0.76	30	0.04
	BORDEN	7	19	335	300	0.88	0.76	37	0.12	5,944	5,294	4.70	4.50	650	0.20
	BOSQUE	5	2	36	32	0.13	0.11	4	0.02	291	269	0.34	0.32	22	0.02
	BRAZOS	4	760	11,767	10,376	46.60	38.73	1,489	8.42	89,635	81,023	167.36	159.33	8,612	8.03
	BREWSTER	5	18	332	297	1.03	0.88	37	0.17	3,215	2,969	3.04	2.90	246	0.14
	BRISCOE	8	7	156	135	0.31	0.28	23	0.03	2,269	1,845	1.31	1.25	424	0.05
	BROOKS	2	3	101	88	0.38	0.32	14	0.07	682	616	1.30	1.24	66	0.06
	BROWN	5	69	1,241	1,104	4.66	3.87	146	0.84	10,056	9,293	11.69	11.15	763	0.54
	BURLESON	4	11	170	150	0.67	0.56	22	0.12	1,297	1,173	2.42	2.31	125	0.12
	BURNET	5	189	3,102	2,759	12.59	10.51	367	2.23	16,472	15,338	30.25	28.78	1,134	1.47
	CALHOUN	3	56	837	748	3.25	2.73	95	0.55	6,990	6,275	12.82	12.23	715	0.59
	CALLAHAN	6	2	37	33	0.12	0.10	5	0.02	356	317	0.34	0.33	39	0.02
	CAMERON	2	1,062	17,848	15,578	68.24	56.87	2,429	12.16	118,603	108,522	237.72	226.51	10,081	11.21
	CHEROKEE	5	16	244	218	0.91	0.77	28	0.16	2,727	2,414	3.70	3.53	312	0.17
	CHILDRESS	7	3	53	47	0.14	0.12	6	0.02	939	836	0.74	0.71	103	0.03
	CLAY	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	COKE	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	COLEMAN	5	1	19	17	0.06	0.05	2	0.01	179	165	0.17	0.16	14	0.01
	COLORADO	4	7	108	96	0.43	0.36	14	0.08	826	746	1.54	1.47	79	0.07
	COMANCHE	5	1	18	16	0.07	0.06	2	0.01	146	135	0.17	0.16	11	0.01
	CONCHO	5	1	18	17	0.06	0.05	2	0.01	179	165	0.17	0.16	14	0.01
	COOKE	6	26	456	404	1.80	1.49	55	0.33	3,362	3,044	4.05	3.85	318	0.20
	CORYELL	5	194	3,489	3,104	13.09	10.89	412	2.36	28,274	26,128	32.87	31.36	2,146	1.51
	COTTLE	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	CRANE	5	2	36	32	0.11	0.09	4	0.02	348	323	0.35	0.34	25	0.02
	CROCKETT	5	19	351	314	1.09	0.92	39	0.18	3,393	3,134	3.21	3.06	260	0.15
	CROSBY	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	CULBERSON	6	3	49	44	0.16	0.14	6	0.02	367	328	0.51	0.49	39	0.02
	DAWSON	7	1	36	31	0.09	0.08	4	0.01	615	537	0.48	0.46	78	0.02
	DE WITT	3	7	105	93	0.41	0.34	12	0.07	874	784	1.60	1.53	89	0.07
	DELTA	6	3	53	47	0.21	0.17	6	0.04	387	350	0.47	0.44	37	0.02
	DICKENS	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	DIMMIT	3	5	85	75	0.32	0.27	11	0.05	397	370	0.82	0.78	27	0.04
	DUVAL	3	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	EASTLAND	6	1	19	16	0.06	0.05	2	0.01	178	158	0.17	0.16	19	0.01
	ECTOR	6	268	4,800	4,275	14.17	12.18	561	2.13	46,602	41,540	47.28	45.20	5,061	2.08
	EDWARDS	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	ERATH	6	45	837	742	2.68	2.26	102	0.44	8,004	7,130	7.71	7.36	874	0.35
	FALLS	5	5	90	80	0.34	0.28	11	0.06	729	673	0.85	0.81	55	0.04
	FANNIN	6	1	18	16	0.07	0.06	2	0.01	129	117	0.16	0.15	12	0.01
	FAYETTE	4	5	77	68	0.31	0.25	10	0.06	590	533	1.10	1.05	57	0.05
	FISHER	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	FOARD	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	FRANKLIN	6	2	35	31	0.14	0.12	4	0.03	258	234	0.31	0.30	24	0.02
	FREESTONE	5	9	162	144	0.61	0.51	19	0.11	1,312	1,212	1.52	1.45	100	0.07
	FRIO	3	11	174	157	0.68	0.57	19	0.11	1,045	960	1.80	1.71	84	0.09

Table 11: 2010 Annual and Peak-day Electricity Savings from Implementation of the 2000 IECC / IRC for Single-family Residences Using 1999 Base Year (2)

2010 Summary TRY 1999

	County	Climate Zone	No. of Projected Units (2010)	Precode Total Annual Elec. Use (MWh/yr)	Code-compliant Total Annual Elec. Use (MWh/yr)	Precode OSD Elec. Use (MWh/day)	Code-compliant OSD Elec. Use (MWh/day)	Total Annual Elec. Savings (MWh/yr) w/ 7% of T&D Loss	Total OSD Elec. Savings (MWh/day) w/ 7% of T&D Loss	Precode Total NG Use (Therm/yr)	Code-compliant Total NG Use (Therm/yr)	Precode OSD NG Use (Therm/day)	Code-compliant OSD NG Use (Therm/day)	Total Annual NG Savings (Therm/yr)	Total OSD NG Savings (Therm/day)
	GILLESPIE	5	34	558	496	2.27	1.89	66	0.40	2,963	2,759	5.44	5.18	204	0.26
	GLASSCOCK	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	GOLIAD	3	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	GONZALES	4	1	16	14	0.06	0.05	2	0.01	95	87	0.16	0.16	8	0.01
	GRAYSON	6	75	1,315	1,167	5.20	4.31	159	0.96	9,699	8,781	11.68	11.10	918	0.58
	GRIMES	4	3	46	41	0.18	0.15	6	0.03	354	320	0.66	0.63	34	0.03
	HALL	8	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	HAMILTON	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	HARDEMAN	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	HASKELL	6	2	37	33	0.12	0.10	5	0.02	356	317	0.34	0.33	39	0.02
	HIDALGO	2	3,101	52,114	45,487	199.26	166.07	7,092	35.51	346,317	316,881	694.14	661.40	29,436	32.75
	HILL	5	9	162	144	0.61	0.51	19	0.11	1,312	1,212	1.52	1.45	100	0.07
	HOPKINS	6	10	176	156	0.70	0.58	21	0.13	1,290	1,168	1.56	1.48	122	0.08
	HOUSTON	5	2	31	27	0.11	0.10	3	0.02	341	302	0.46	0.44	39	0.02
	HOWARD	6	2	36	32	0.11	0.09	4	0.02	348	310	0.35	0.34	38	0.02
	HUDSPETH	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	IRION	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	JACK	6	4	74	66	0.24	0.20	9	0.04	711	634	0.69	0.65	78	0.03
	JACKSON	3	12	179	160	0.70	0.59	20	0.12	1,498	1,345	2.75	2.62	153	0.13
	JEFF DAVIS	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	JIM HOGG	2	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	JIM WELLS	3	18	289	254	1.10	0.93	38	0.19	1,937	1,773	4.02	3.83	164	0.19
	JONES	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KARNES	3	25	395	354	1.52	1.29	43	0.25	2,309	2,130	4.21	4.02	179	0.19
	KENDALL	5	202	3,200	2,877	12.41	10.51	345	2.03	19,148	17,572	33.04	31.47	1,576	1.57
	KENEDY	2	41	689	601	2.63	2.20	94	0.47	4,579	4,190	9.18	8.74	389	0.43
	KENT	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KERR	5	41	673	598	2.73	2.28	80	0.48	3,573	3,327	6.56	6.24	246	0.32
	KIMBLE	5	1	18	17	0.06	0.05	2	0.01	179	165	0.17	0.16	14	0.01
	KING	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KINNEY	4	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	KLEBERG	2	19	305	268	1.16	0.98	39	0.20	2,042	1,870	4.25	4.04	172	0.20
	KNOX	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	LA SALLE	3	6	102	90	0.39	0.33	13	0.06	476	444	0.99	0.94	32	0.05
	LAMAR	6	46	754	665	3.03	2.49	96	0.58	7,924	6,707	9.73	9.25	1,217	0.49
	LAMPASAS	5	14	252	224	0.94	0.79	30	0.17	2,040	1,886	2.37	2.26	155	0.11
	LAVACA	4	9	134	120	0.52	0.44	15	0.09	1,121	1,004	2.06	1.96	117	0.10
	LEE	4	4	66	58	0.27	0.22	8	0.05	349	325	0.64	0.61	24	0.03
	LEON	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	LIMESTONE	5	4	72	64	0.27	0.22	8	0.05	583	539	0.68	0.65	44	0.03
	LIVE OAK	3	8	128	113	0.49	0.41	17	0.08	861	788	1.79	1.70	73	0.08
	LLANO	5	195	3,200	2,846	12.99	10.85	379	2.30	16,994	15,825	31.21	29.69	1,170	1.52
	LOVING	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MADISON	4	19	294	259	1.17	0.97	37	0.21	2,241	2,026	4.18	3.98	215	0.20
	MARTIN	6	9	161	144	0.48	0.41	19	0.07	1,565	1,395	1.59	1.52	170	0.07
	MASON	5	9	148	131	0.60	0.50	17	0.11	784	730	1.44	1.37	54	0.07
	MATAGORDA	3	68	1,016	908	3.94	3.32	116	0.67	8,488	7,620	15.56	14.85	869	0.72
	MAVERICK	3	156	2,642	2,329	10.07	8.51	335	1.67	12,377	11,543	25.67	24.45	834	1.21
	MCCULLOCH	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MCLENNAN	5	442	7,949	7,072	29.83	24.80	938	5.38	64,419	59,530	74.89	71.45	4,889	3.44
	MCMULLEN	3	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
ERCOT	MEDINA	4	12	190	171	0.74	0.63	21	0.12	1,141	1,050	1.96	1.87	91	0.09
	MENARD	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MIDLAND	6	394	7,057	6,286	20.83	17.91	825	3.13	68,511	61,070	69.51	66.45	7,441	3.06
	MILAM	4	3	49	43	0.19	0.16	6	0.03	263	243	0.49	0.46	20	0.02
	MILLS	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MITCHELL	6	1	19	16	0.06	0.05	2	0.01	178	158	0.17	0.16	19	0.01
	MONTAGUE	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	MOTLEY	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	NACOGDOCHES	5	38	580	518	2.17	1.82	65	0.37	6,476	5,734	8.79	8.39	742	0.40
	NAVARRO	5	10	180	160	0.67	0.56	21	0.12	1,457	1,347	1.69	1.62	111	0.08
	NOLAN	6	1	19	16	0.06	0.05	2	0.01	178	158	0.17	0.16	19	0.01
	PALO PINTO	6	16	298	264	0.95	0.80	36	0.16	2,846	2,535	2.74	2.62	311	0.12
	PECOS	5	6	111	99	0.34	0.29	12	0.06	1,072	990	1.01	0.97	82	0.05
	PRESIDIO	5	2	37	33	0.11	0.10	4	0.02	357	330	0.34	0.32	27	0.02
	RAINS	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	REAGAN	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	REAL	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	RED RIVER	6	11	180	159	0.72	0.60	23	0.14	1,895	1,604	2.33	2.21	291	0.12
	REEVES	6	1	18	16	0.05	0.05	2	0.01	174	155	0.18	0.17	19	0.01
	REFUGIO	3	3	45	40	0.17	0.15	5	0.03	374	336	0.69	0.65	38	0.03
	ROBERTSON	4	6	93	82	0.37	0.31	12	0.07	708	640	1.32	1.26	68	0.06
	RUNNELS	5	1	18	17	0.06	0.05	2	0.01	179	165	0.17	0.16	14	0.01
	SAN SABA	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SCHLEICHER	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SCURRY	7	50	880	790	2.30	2.01	97	0.32	15,642	13,931	12.38	11.85	1,711	0.53
	SHACKELFORD	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SOMERVELL	5	8	140	125	0.56	0.46	16	0.10	1,032	950	1.25	1.18	82	0.06
	STARR	2	2	34	29	0.13	0.11	5	0.02	223	204	0.45	0.43	19	0.02
	STEPHENS	6	3	56	49	0.18	0.15	7	0.03	534	475	0.51	0.49	58	0.02
	STERLING	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	STONEWALL	7	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	SUTTON	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	TAYLOR	6	270	5,025	4,453	16.06	13.57	612	2.66	48,024	42,781	46.28	44.18	5,243	2.10
	TERRELL	5	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	THROCKMORTON	6	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	TITUS	6	4	66	58	0.26	0.22	8	0.05	689	583	0.85	0.80	106	0.04
	TOM GREEN	5	177	3,269	2,925	10.15	8.61	368	1.65	31,610	29,191	29.88	28.50	2,419	1.38
	UPTON	5	1	18	16	0.05	0.05	2	0.01	174	161	0.18	0.17	13	0.01
	UVALDE	4	10	159	143	0.62	0.52	17	0.10	951	875	1.64	1.56	76	0.08
	VAL VERDE	4	30	476	428	1.85	1.56	52	0.30	2,852	2,624	4.91	4.67	229	0.23
	VAN ZANDT	6	5	88	78	0.35	0.29	11	0.06	645	584	0.78	0.74	61	0.04
	WARD	6	7	125	112	0.37	0.32	15	0.06	1,217	1,085	1.23	1.18	132	0.05
	WASHINGTON	4	54	836	737	3.31	2.75	106	0.60	6,369	5,757	11.89	11.32	612	0.57
	WEBB	3	636	10,770	9,493	41.05	34.68	1,366	6.82	50,461	47,061	104.64	99.70	3,400	4.95
	WHARTON	3	61	912	815	3.54	2.98	104	0.60	7,614	6,835	13.96	13.32	779	0.64
	WICHITA	7	145	2,962	2,604	9.52	7.95	383	1.68	30,787	27,230	24.34	23.21	3,557	1.13
	WILBARGER	7	2	41	36	0.13	0.11	5	0.02	425	376	0.34	0.32	49	0.02
	WILLACY	2	16	269	235	1.03	0.86	37	0.18	1,787	1,635	3.58	3.41	152	0.17
	WINKLER	6	1	18	16	0.05	0.05	2	0.01	174	155	0.18	0.17	19	0.01
	WISE	6	31	544	482	2.16	1.78	66	0.40	3,999	3,619	4.83	4.59	380	0.24
	YOUNG	6	5	93	82	0.30	0.25	11	0.05	889	792	0.86	0.82	97	0.04
	ZAPATA	2	0	0	0	0.00	0.00	0	0.00	0	0	0.00	0.00	0	0.00
	ZAVALA	3	4	68	60	0.26	0.22	9	0.04	317	296	0.66	0.63	21	0.03
	TOTAL		66,017					131,839	746					706,054	599

Table 12: Allocation of PCA for each of 41 non-attainment and Affected Counties, and ERCOT Counties (1)

County	Elec. Utilities 1	PCA	Percentage	Elec. Utilities 2	PCA	Percentage
ANDERSON	ONCOR	TXU Electric/PCA	100%	Trinity Valley EC		0%
ANDREWS	ONCOR	TXU Electric/PCA	100%	Cap Rock EC		0%
ANGELINA	ONCOR	TXU Electric/PCA	100%	Sam Houston EC		0%
ARANSAS	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	San Patricio EC		0%
ARCHER	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
ATASCOSA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	54%	CPSB	San Antonio Public Service Bd/PCA	46%
AUSTIN	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	100%	Bellville		0%
BANDERA*	Bandera EC					
BASTROP	ONCOR	TXU Electric/PCA	100%	Smithville		0%
BAYLOR	ONCOR	TXU Electric/PCA	100%	Seymour		0%
BEE	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	San Patricio EC		0%
BELL	ONCOR	TXU Electric/PCA	100%	Bartlett EC		0%
BEXAR	CPSB	San Antonio Public Service Bd/PCA	100%	Bandera EC		0%
BLANCO*	Pedernales EC			Central Texas EC		
BORDEN*	Lyntegar EC			Big Country EC		
BOSQUE	T-NMP	Texas-New Mexico Power Co/PCA	100%	United Coop Services		0%
BRAZORIA	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	97%	T-NMP	Texas-New Mexico Power Co/PCA	3%
BRAZOS*	BRYAN			College Station		
BREWSTER	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
BRISCOE	XCEL(SPS)			WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%
BROOKS	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%
BROWN	ONCOR	TXU Electric/PCA	85%	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	15%
BURLESON	ENTERGY	Entergy Electric System/PCA	100%	BRYAN		0%
BURNET	ONCOR	TXU Electric/PCA	100%	Pedernales EC		0%
CALDWELL	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Luling		0%
CALHOUN	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Victoria EC		0%
CALLAHAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Taylor EC		0%
CAMERON	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Magic Valley EC		0%
CHAMBERS	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	70%	ENTERGY	Entergy Electric System/PCA	30%
CHEROKEE	ONCOR	TXU Electric/PCA	100%	Cherokee County EC		0%
CHILDRESS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Greenbelt EC		0%
CLAY	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
COKE	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Concho Valley EC		0%
COLEMAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Coleman		0%
COLLIN	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
COLORADO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Weimar		0%
COMAL	CPSB	San Antonio Public Service Bd/PCA	100%	New Braunfels		0%
COMANCHE	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
CONCHO	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Concho Valley EC		0%
COOKE	ONCOR	TXU Electric/PCA	100%	Cooke County EC		0%
CORYELL	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
COTTLE	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	South Plains EC		0%
CRANE	ONCOR	TXU Electric/PCA	100%			0%
CROCKETT	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
CROSBY*	XCEL(SPS)			Crosbyton		
CULBERSON	EPEC	El Paso Electric Co/PCA	100%	Rio Grande EC		0%
DALLAS	ONCOR	TXU Electric/PCA	100%	Garland		0%
DAWSON	ONCOR	TXU Electric/PCA	100%	Lyntegar EC		0%
DELTA	ONCOR	TXU Electric/PCA	100%	Lamar County EC		0%
DENTON	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
DEWITT	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Yoakum		0%
DICKENS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	South Plains EC		0%
DIMMIT	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%
DUVAL	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%
EASTLAND	ONCOR	TXU Electric/PCA	85%	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	15%
ECTOR	ONCOR	TXU Electric/PCA	100%	Goldsmith		0%
EDWARDS	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
ELLIS	ONCOR	TXU Electric/PCA	100%	Navarro County EC		0%
ERATH	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
FALLS	ONCOR	TXU Electric/PCA	100%	Belfalls EC		0%
FANNIN	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
FAYETTE*	La Grange			Schulenburg		
FISHER	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Big Country EC		0%
FOARD*	XCEL(SPS)			Floydada		
FORT BEND	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	100%			0%
FRANKLIN	SWEPCO(AEP)	Southwestern Public Service Co/PCA		FEC Electric		
FREESTONE	ONCOR	TXU Electric/PCA	100%	Navasota Valley EC		0%
FRIO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%
GALVESTON	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	97%	T-NMP	Texas-New Mexico Power Co/PCA	3%
GILLESPIE*	Fredericksburg			Pedernales EC		
GLASSCOCK	ONCOR	TXU Electric/PCA	100%	Cap Rock EC		0%
GOLIAD	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Karnes EC		0%
GONZALES	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Gonzales		0%
GRAYSON	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
GRIMES	ENTERGY	Entergy Electric System/PCA	100%	Mid-South EC		0%
GUADALUPE	CPSB	San Antonio Public Service Bd/PCA	100%	Seguin		0%
HALL	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Lighthouse EC		0%
HAMILTON	T-NMP	Texas-New Mexico Power Co/PCA	100%	United Coop Services		0%
HARDEMAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	South Plains EC		0%
HARRIS	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	70%	ENTERGY	Entergy Electric System/PCA	30%
HASKELL	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Big Country EC		0%
HAYS	San Marcos	Lower Colorado River Authority/PCA	100%	Pedernales EC		0%
HENDERSON	ONCOR	TXU Electric/PCA	100%	Trinity Valley EC		0%
HIDALGO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Magic Valley EC		0%
HILL	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
HOOD	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
HOPKINS	ONCOR	TXU Electric/PCA	100%	SWEPCO(AEP)		0%
HOUSTON	ONCOR	TXU Electric/PCA	100%	Houston County EC		0%
HOWARD	ONCOR	TXU Electric/PCA	100%	Cap Rock EC		0%
HUDSPETH	EPEC	El Paso Electric Co/PCA	100%	Rio Grande EC		0%
HUNT	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
IRION	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Cap Rock EC		0%
JACK	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
JACKSON	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Jackson EC		0%
JEFF DAVIS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
JIM HOGG	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%
JIM WELLS	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Nueces EC		0%
JOHNSON	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
JONES	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Taylor EC		0%
KARNES	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Floresville		0%

Table 13: Allocation of PCA for each of 41 non-attainment and Affected Counties, and ERCOT Counties (2)

County	Elec. Utilities 1	PCA	Percentage	Elec. Utilities 2	PCA	Percentage
KAUFMAN	ONCOR	TXU Electric/PCA	100%	Trinity Valley EC		0%
KENDALL*	Boerne			Central Texas EC		
KENEDY*	Nueces EC			Magic Valley EC		
KENT	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	South Plains EC		0%
KERR*	Kerrville			Bandera EC		
KIMBLE	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Central Texas EC		0%
KING	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	South Plains EC		0%
KINNEY	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
KLEBERG	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Nueces EC		0%
KNOX	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Tri-County EC		0%
LA SALLE	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%
LAMAR	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
LAMPASAS	ONCOR	TXU Electric/PCA	100%	Lampasas		0%
LAVACA*	Schulenburg			Yoakum		
LEE*	Giddings			Lexington		
LEON	ONCOR	TXU Electric/PCA	75%	ENTERGY	Entergy Electric System/PCA	25%
LIMESTONE	ONCOR	TXU Electric/PCA	75%	ENTERGY	Entergy Electric System/PCA	25%
LIVE OAK	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	San Patricio EC		0%
LLANO*	Llano			Pedernales EC		
LOVING	ONCOR	TXU Electric/PCA	100%			0%
MADISON	ENTERGY	Entergy Electric System/PCA	100%	Houston County EC		0%
MARTIN	ONCOR	TXU Electric/PCA	100%	Cap Rock EC		0%
MASON*	Mason			Cap Rock EC		
MATAGORDA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	19%	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	81%
MAVERICK	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
McCULLOCH	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Brady		0%
McLENNAN	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
McMULLEN	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Karnes EC		0%
MEDINA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	54%	CPSB	San Antonio Public Service Bd/PCA	46%
MENARD	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Cap Rock EC		0%
MIDLAND	ONCOR	TXU Electric/PCA	100%	Cap Rock EC		0%
MILAM	ONCOR	TXU Electric/PCA	75%	ENTERGY	Entergy Electric System/PCA	25%
MILLS*	Goldwaithe			Cap Rock EC		
MITCHELL	ONCOR	TXU Electric/PCA	100%	Cap Rock EC		0%
MONTAGUE	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
MONTGOMERY	ENTERGY	Entergy Electric System/PCA	30%	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	70%
MOTLEY	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Lighthouse EC		0%
NACOGDOCHES	ONCOR	TXU Electric/PCA	100%	Cherokee County EC		0%
NAVARRO	ONCOR	TXU Electric/PCA	100%	Navarro County EC		0%
NOLAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	15%	ONCOR	TXU Electric/PCA	85%
NUECES	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Robstown		0%
PALO PINTO	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
PARKER	ONCOR	TXU Electric/PCA	100%	Weatherford		0%
PECOS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	15%	ONCOR	TXU Electric/PCA	85%
PRESIDIO	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
RAINS	T-NMP	Texas-New Mexico Power Co/PCA	100%	FEC Electric		0%
REAGAN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Cap Rock EC		0%
REAL	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Bandera EC		0%
RED RIVER	ONCOR	TXU Electric/PCA	100%	SWEPCO(AEP)		0%
REEVES	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	15%	ONCOR	TXU Electric/PCA	85%
REFUGIO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	San Patricio EC		0%
ROBERTSON	ENTERGY	Entergy Electric System/PCA	100%	Hearne		0%
ROCKWALL	ONCOR	TXU Electric/PCA	100%	FEC Electric		0%
RUNNELS	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Coleman County EC		0%
RUSK	SWEPCO(AEP)	Southwestern Public Service Co/PCA	0%	ONCOR	TXU Electric/PCA	100%
SAN PATRICIO	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	San Patricio EC		0%
SAN SABA*	San Saba			Central Texas EC		
SCHLEICHER	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Pedernales EC		0%
SCURRY	ONCOR	TXU Electric/PCA	100%	Cap Rock EC		0%
SHACKELFORD	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Fort Belknap EC		0%
SMITH	ONCOR	TXU Electric/PCA	100%	SWEPCO(AEP)		0%
SOMERVELL	T-NMP	Texas-New Mexico Power Co/PCA	100%	United Coop Services		0%
STARR	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%
STEPHENS	ONCOR	TXU Electric/PCA	100%	Comanche EC		0%
STERLING	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Cap Rock EC		0%
STONEWALL	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Big Country EC		0%
SUTTON	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Pedernales EC		0%
TARRANT	ONCOR	TXU Electric/PCA	100%	Tri-County EC		0%
TAYLOR	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Taylor EC		0%
TERRELL	T-NMP	Texas-New Mexico Power Co/PCA	100%	Rio Grande EC		0%
THROCKMORTON	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Fort Belknap EC		0%
TITUS	SWEPCO(AEP)	Southwestern Public Service Co/PCA	0%	T-NMP	Texas-New Mexico Power Co/PCA	100%
TOM GREEN	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Concho Valley EC		0%
TRAVIS	ONCOR	TXU Electric/PCA	97%	Austin Energy	Austin Energy/PCA	3%
UPTON	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	15%	ONCOR	TXU Electric/PCA	85%
UVALDE	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Bandera EC		0%
VAL VERDE	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
VAN ZANDT	ONCOR	TXU Electric/PCA	100%	SWEPCO(AEP)		0%
VICTORIA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Victoria EC		0%
WALLER	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	100%	Hempstead		0%
WARD	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
WASHINGTON	ENTERGY	Entergy Electric System/PCA	100%	Bluebonnet EC		0%
WEBB	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Rio Grande EC		0%
WHARTON	RELIANT(CENTER POINT)	Reliant Energy HL&P/PCA	81%	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	19%
WICHITA	ONCOR	TXU Electric/PCA	100%	Electra		0%
WILBARGER	WTU(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Vernon		0%
WILLACY	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Magic Valley EC		0%
WILLIAMSON	ONCOR	TXU Electric/PCA	97%	Austin Energy	Austin Energy/PCA	3%
WILSON	Floresville	San Antonio Public Service Bd/PCA	100%	Guadalupe Valley EC		
WINKLER	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
WISE	ONCOR	TXU Electric/PCA	100%	Bridgeport		0%
YOUNG	ONCOR	TXU Electric/PCA	98%	T-NMP	Texas-New Mexico Power Co/PCA	2%
ZAPATA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%
ZAVALA	CPL(AEP)	American Electric Power - West (ERCOT)/PCA	100%	Medina EC		0%

Table 14: 2010 Totalized Annual Electricity Savings from the 2000 IECC / IRC by PCA for Single-family Residences Using 1999 Base Year

PCA	Total Electricity Savings by PCA (MWh) 2010-TRY 1999
American Electric Power - West (ERCOT)/PCA	15,208.46
Austin Energy/PCA	354.87
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	2,291.89
Reliant Energy HL&P/PCA	35,883.11
San Antonio Public Service Bd /PCA	8,562.67
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	647.36
TXU Electric/PCA	51,094.67
El Paso Electric Co/PCA	30.13
Entergy Electric System/PCA	8,750.52
Total	122,823.67

Table 15: 2010 Annual NOx Reductions from the 2000 IECC / IRC by PCA for Single-family Residences by County Using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00883113	134.307922	0.010890729	3.86477634	0.006522185	0	0.003944232	9.039755838	0.0654443	2348.344504	0.014877	127.390541	0.006262	0	0.0048171	0	0.121275	78.50829036	0.00816387	417.1302499	3118.586039	1.55929302
	Chambers	0.02176222	330.969885	0.026955801	9.56576386	0.016072371	0	0.009076193	20.80165986	0.1649402	5918.567711	0.037472	320.86285	0.015056	0	0.0095532	0	0.011519	7.456648026	0.01581859	808.2457561	7416.470274	3.708235137
	Fort Bend	0.07043123	1071.1506	0.087239726	30.9586284	0.052016606	0	0.029374182	67.32247068	0.5338124	19154.84649	0.121275	1038.4402	0.048726	0	0.030918	0	0.037279	24.13268804	0.05119528	2615.805738	24002.65681	12.0013284
	Galveston	0.03385674	514.908863	0.041710519	14.801748	0.025004711	0	0.015351589	35.18419276	0.2495874	8955.970563	0.056747	485.906215	0.024143	0	0.0192972	0	0.567751	367.5381862	0.03283689	1677.789888	12052.09965	6.026049827
	Harris	0.06826733	1038.24099	0.084559408	30.0074678	0.050418468	0	0.028471701	65.25408178	0.5174117	18566.34058	0.117549	1006.53557	0.047229	0	0.0299681	0	0.036133	23.3912449	0.04962237	2535.43876	23265.2087	11.63260435
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00203914	31.0121053	0.003716345	1.31881354	0.001505992	0	0.005950953	13.63894454	0.0024815	89.04314676	0.000717	6.13986809	0.019166	0	0.0766809	0	0.000864	0.559582659	0.0040002	204.3888637	346.1013246	0.173050662
	Dallas	0.00453947	69.0383652	0.004683963	1.66219066	0.003352602	0	0.00774211	17.74408461	0.0020856	74.83820937	0.000681	5.83169412	0.007503	0	0.026717	0	0.007525	4.871324201	0.04037045	2062.71502	2236.700889	1.118350444
	Denton	0.00047388	7.20698946	0.000872802	0.30972974	0.000349982	0	0.001396994	3.201759869	0.0005854	21.00752658	0.000169	1.44683859	0.004544	0	0.0181872	0	0.000187	0.120800524	0.00084941	43.40008784	76.6937326	0.038346866
	Tarrant	0.01216249	184.972778	0.012266309	4.35292647	0.008982543	0	0.020308652	46.54524991	0.0053165	190.7726987	0.001753	15.0061294	0.017326	0	0.0602168	0	0.020603	13.33780064	0.11064724	5653.484056	6108.471638	3.054235819
	Ellis	0.00327981	49.8809128	0.003307809	1.1738373	0.002422289	0	0.005476558	12.55168237	0.0014337	51.4449557	0.000473	4.04664644	0.004672	0	0.0162384	0	0.005556	3.596754502	0.02983782	1524.553769	1647.248558	0.823624279
	Johnson	0.00028606	4.35050895	0.000526868	0.18696878	0.000211267	0	0.000843297	1.93274668	0.0003534	12.68122187	0.000102	0.87338607	0.002743	0	0.0109787	0	0.000113	0.0729214	0.00051274	26.1985218	46.29627554	0.023148138
	Kaufman	0.00632545	96.2003915	0.006379446	2.2638641	0.004671629	0	0.010562096	24.20719048	0.002765	99.21680655	0.000911	7.80436743	0.009011	0	0.0313175	0	0.010715	6.936705277	0.05754527	2940.256324	3176.885649	1.588442825
	Parker	0.00021749	3.30768007	0.000400576	0.14215185	0.000160626	0	0.000641157	1.469462023	0.0002687	9.641498358	7.75E-05	0.66403305	0.002085	0	0.0083471	0	8.56E-05	0.055441941	0.00038984	19.91866458	35.19893187	0.017599466
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00081989	12.4693392	0.000826893	0.29343841	0.000605529	0	0.001369042	3.137696901	0.0003584	12.86032209	0.000118	1.01158949	0.001168	0	0.0040593	0	0.001389	0.899124525	0.00745892	381.111272	411.7827827	0.205891391
	Hood	0.01252711	190.51805	0.012634039	4.48342222	0.009251829	0	0.020917482	47.94062321	0.0054759	196.4918458	0.001805	15.455996	0.017846	0	0.062022	0	0.021221	13.73765263	0.11396431	5822.969034	6291.596623	3.145798312
	Hunt	0.00618756	94.1032337	0.006240374	2.21451211	0.004569788	0	0.010331844	23.67947644	0.0027047	97.05389126	0.000892	7.6342331	0.008815	0	0.0306347	0	0.010482	6.785485878	0.05629078	2876.159065	3107.629897	1.553814949
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03341375	508.171695	0.051775843	18.3736144	0.024677545	0	0.090663423	207.7908307	0.0011418	40.97281172	1.143572	9792.02635	0.046874	0	0.0046695	0	0.00052	0.336355677	0.00250387	127.9341648	10695.60582	5.34780291
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200047	30.4240249	0.076378745	27.1044084	0.001477434	0	0.133848731	306.7669176	0.0012371	44.39216718	0.003555	30.4385436	0.001062	0	0.0018557	0	0.000402	0.260055498	0.00183516	93.76714054	533.1532577	0.266576629
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00450233	68.4735635	0.171901148	61.0022978	0.003325174	0	0.301245466	690.4222593	0.0027843	99.91083981	0.008001	68.50624	0.00239	0	0.0041765	0	0.000904	0.585291614	0.0041303	211.0361884	1199.93668	0.59996834
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.0024586	37.3915067	0.093870431	33.3116565	0.001815785	0	0.164501762	377.0203746	0.0015205	54.55852812	0.004369	37.4093504	0.001305	0	0.0022807	0	0.000494	0.319611456	0.00225544	115.2409873	655.2520152	0.327626008
	Travis	0.00051001	7.75642123	0.299602906	106.319625	0.000376663	0	0.033939476	77.78563496	0.0003347	12.01039107	0.000906	7.75881423	0.000271	0	0.0004717	0	0.000103	0.066889455	0.00046734	23.87836686	235.5761431	0.117788072
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.00068596	10.4324688	0.00069182	0.24550515	0.000506616	0	0.001145408	2.625153143	0.0002999	10.7595845	9.88E-05	0.84634604	0.000977	0	0.0033962	0	0.001162	0.752252256	0.00624051	318.856628	344.5179379	0.172258969
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	3460.96992	0.004556851	1.61708286	0.168069652	0	0.007612767	17.44764474	0.0016809	60.31547851	0.001627	13.9297154	0.046792	0	0.0072464	0	0.001609	1.041874467	0.00828339	423.2373181	3978.559036	1.989279518
	San Patricio	0.05031335	765.188589	0.001007478	0.35752213	0.037158653	0	0.001683113	3.857513634	0.0003716	13.33519705	0.00036	3.07973185	0.010345	0	0.0016021	0	0.000356	0.230348854	0.00183138	93.57387485	879.6227774	0.439811389
Victoria Area	Victoria	0.02183674	332.103121	0.002215582	0.78624026	0.016127403	0	0.003612695	8.279909605	0.0011996	43.04613273	0.000555	4.75561038	0.525456	0	0.0324127	0	0.000477	0.308696027	0.00225485	115.2107736	504.4904832	0.252245242
Other ERCOT counties	Andrews	2.4742E-05	0.37628897	2.49533E-05	0.00885513	1.82731E-05	0	4.13138E-05	0.094686713	1.082E-05	0.388087716	3.57E-06	0.03052688	3.52E-05	0	0.0001225	0	4.19E-05	0.027133005	0.00022509	11.50084751	12.42642592	0.006213213
	Angelina	0.00031082	4.72709231	0.000313473	0.11124169	0.000229554	0	0.000519	1.18949229	0.0001359	4.875312833	4.48E-05	0.3834908	0.000443	0	0.0015389	0	0.000527	0.340855642	0.00282766	144.478238	156.1057236	0.078052862
	Bosque	0.00059539	9.05499192	0.001096604	0.38915005	0.000439723	0	0.001755208	4.022749016	0.0007356	26.3942364	0.000212	1.81783417	0.005709	0	0.0228507	0	0.000234	0.151775963	0.00106721	54.52865543	96.35939295	0.048179696
	Brazos	0.00193973	29.5002331	0.003572622	1.26781087	0.001432574	0	0.005718288	13.10570289	0.0023964	85.98970973	0.000692	5.92231692	0.018599	0	0.0744451	0	0.000764	0.49447049	0.00347685	177.6487556	313.9289996	0.1569645
	Calhoun	0.08269981	1257.73673	0.001655986	0.58765738	0.061077496	0	0.002766524	6.340576235	0.0006108	21.91899798	0.000591	5.06214014	0.017004	0	0.0026334	0	0.000585	0.37862328	0.00301023	153.806919	1445.831644	0.722915822
	Cameron	0.04837175	735.659778	0.000968599	0.34372527	0.297964476	0	0.001618161	3.708651257	0.0003573	12.8205886	0.000346	2.96088426	0.009946	0	0.0015403	0	0.000342	0.221459636	0.00176071	89.96283655	845.6779233	0.422838962
	Cherokee	0.0035039	53.2889062	0.003533808	1.25403691	0.002587786	0	0.00585073	13.40924588	0.0015316	54.95980855	0.000505	4.32312382	0.004992	0	0.0173479	0	0.005936	3.842494102	0.03187642	1628.715238	1759.792853	0.879896426
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.00129879	19.7525483	2.6007E-05	0.00922906	0.000959212	0	4.34478E-05	0.099577706	9.593E-06	0.344234255	9.28E-06	0.07950008	0.000267	0	4.136E-05	0	9.19E-06	0.005946216	4.7275E-05	2.415512341	22.70654793	0.011353274
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00353575	53.7732764	0.003565928	1.26543549	0.002611307	0	0.005903911	13.53112939	0.0015456	55.45936644	0.000509	4.36241891	0.005037	0	0.0175056	0	0.00599	3.877420502	0.03216616	1643.519466	1775.788513	0.887894256
	Fannin	0.00705631	107.31568	0.007116546	2.5254379	0.005211403	0	0.011782473	27.0041635	0.0030845	110.6806206	0.001017	8.70610798	0.010052	0	0.034936	0	0.011954	7.738193477	0.06419422	3279.982556	3543.95276	1.77197638
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00367718	55.9242074	0.003708565	1.31605291	0.00271576	0	0.006140067	14.07237457	0.0016074	57.67774109	0.00053	4.53691567	0.005238	0	0.0182058	0	0.006229	4.032517322	0.03345281	1709.260244	1846.820053	0.923410027
	Frio	0.00858833	130.615344	0.000871383	0.30922637	0.006342868	0	0.001420864	3.256468166	0.0004718	16.92993856	0.000218	1.87036991	0.206661	0	0.0127478	0	0.000188	0.121409391	0.00088683	45.31211506	198.4148713	0.099207436
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.18852746	2867.21227	0.003775086	1.33965909	0.139235931	0	0.006306735	14.4543588	0.0013925	49.96786561	0.001348	11.539959	0.038764	0	0.0060032	0	0.001333	0.863132394	0.00686231	350.6274998	3296.004742	1.648002371
	Howard	0.00055511	8.44241456	0.000559851	0.19867361	0.000409976	0	0.000926915	2.124389873	0.0002427	8.707131018	8E-05	0.68490059	0.000791	0	0.0027484	0	0.00094	0.608755752	0.00505009	258.0328669	278.7991323	0.139399566
	Jack	0.00212145	32.2639658	0.002139557	0.7592613	0.001566784	0	0.003542346	8.118677635	0.0009273	33.27561986	0.000306	2.61745135	0.003022	0	0.0105033	0	0.003594	2.326452301	0.0192997	986.1116794	1065.473108	0.532736554
	Jones	0.04071872	619.269056	0.000815354	0.28934357	0.030072592	0	0.001362147	3.12189552	0.0003008	10.79220863	0.000291	2.49243476	0.008372	0	0.0012966	0	0.000288	0.186421909	0.00148214	75.7295731	711.880934	0.355940467
	Lamar	0.00095084	14.4607793	0.000958954	0.34030256	0.000702236	0	0.001587687	3.638808886	0.0004156	14.91420483	0.000137	1.17314736	0.001355	0	0.0047076	0	0.001611	1.042720956	0.00865017	441.9773888	477.5473527	0.238773676
	Limestone	0.00071976	10.9463922	0.000891528	0.31637502	0.000531572	0	0.000300183	0.687987451	0.0054552	195.7488172	0.001239	10.6121154	0.000498	0	0.000316	0	0.000381	0.246618794	0.00052318	26.73166186	245.2899679	0.122644984
	Llano	0.00123817	18.830719	0.047274044	16.7760676	0.000914447	0	0.082844655	189.8710525	0.0007657	27.47619454	0.0022	18.8397053	0.000657	0	0.0011486	0	0.000249	0.160959374	0.00113586	58.0364591	329.9911574	0.164995579
	McLennan	0.02453432	373.129182	0.024743738	8.78077257	0.018119687	0	0.040966843	93.89160527	0.0107245	384.8288484	0.003535	30.2705342	0.034951	0	0.1214699	0	0.041562	26.90516251	0.22319886	11404.27206	12322.07817	6.161039084
	Milam	0.0022454	34.1491508	0.002264571	0.80362497	0.001658332	0	0.003749326	8.593052327	0.0009815	35.2199158	0.000324	2.77038914	0.003199	0	0.011117	0	0.003804	2.462387011	0.02042738	1043.730228	1127.728748	0.563864374
	Mitchell	0.01494317	227.262583	0.015070721	5.3481238	0.011036196	0	0.024951762	57.18675947	0.006532	234.3885242	0.002153	18.4369385	0.021288	0	0.073984	0	0.025314	16.38718448	0.1359442	6946.024212	7505.034326	3.752517163
	Nolan	0.00056465	8.58751324	0.000569473	0.20208819	0.000417022	0	0.000942846	2.160901486	0.0002468	8.856779346	8.14E-05	0.69667189	0.000804	0	0.0027956	0	0.000957	0.619218358	0.00513689	262.4676442	283.5908167	0.141795408
	Palo Pinto	0.003207	48.7735059	0.005906709	2.09610483	0.002368511	0	0.009454195	21.66800088	0.003962	142.169033	0.001144	9.79152124	0.03075	0	0.1230821	0	0.001263	0.817520977	0.00574838	293.7113275	519.0270144	0.259513507
	Pecos	4.0968E-05	0.6230553	4.13174E-05	0.01466223	3.02565E-05	0	6.84069E-05	0.156781259	1.791E-05	0.64259154	5.9E-06	0.05054608	5.84E-05	0	0.0002028	0	6.94E-05	0.044926543	0.0003727	19.04298177	20.57554472	0.010287772
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00073771	11.2193985	0.000835096	0.29634938	0.00054483	0	0.000735917	1.686642873	0.0031497	113.0202254	0.000731	6.2582432	0.000761	0	0.0018663	0	0.191633	124.0548074	0.00339774	173.606271	430.1419377	0.215070969
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.00569644	86.6340398	0.005745061	2.0387411	0.004207073	0	0.009511781	21.79998097	0.00249	89.35049675	0.000821	7.02828615	0.008115	0	0.0282032	0	0.00965	6.246905982	0.05182285	2647.871588	2860.970039	1.430485019
	Tom Green	0.00148245	22.5457519	2.96846E-05	0.01053414	0.001094854	0	4.95918E-05	0.113658968	1.095E-05	0.392912346	1.06E-05	0.09074217	0.000305	0	4.72E-05	0	1.05E-05	0.006787069	5.396E-05	2.75708942	25.91747597	0.012958738
	Upton	3.1166E-05	0.47398879	3.14322E-05	0.01115428	2.30176E-05	0	5.20405E-05	0.119271209	1.362E-05	0.488850967	4.49E-06	0.03845289	4.44E-05	0	0.0001543	0	5.28E-05	0.034177829	0.00028353	14.48693219	15.65282816	0.007826414
	Ward	0.01855953	282.261848	0.01871795	6.64241023	0.013707039	0	0.030990277	71.0263879	0.0081128	291.1123203	0.002674	22.8988172	0.02644	0	0.0918886	0	0.03144	20.3530071	0.16884373	8627.01462	9321.309411	4.660654705
	Webb	0.02001433	304.387095	0.000400768	0.14222	0.014781473	0	0.000669531	1.53449409	0.0001478	5.304655541	0.000143	1.2250975	0.004115	0	0.0006373	0	0.000142	0.091631291	0.00072851	37.22308502	349.9082781	0.174954139
	Wharton	0.00014434	2.19518451	0.000178787	0.0634457	0.000106601	0	6.01986E-05	0.13796869	0.001094	39.25537856	0.000249	2.12814878	9.99E-05	0	6.336E-05	0	7.64E-05	0.049456821	0.00010492	5.360755284	49.19033834	0.024595169
	Wichita	0.00020763	3.15778136	0.000209406	0.07431142	0.000153346	0	0.000346701	0.794601912	9.076E-05	3.256795299	2.99E-05	0.25617865	0.000296	0	0.001028	0	0.000352	0.227697604	0.00188893	96.51402122	104.2813875	0.052140694
	Wilbarger	0.02861682	435.217732	0.000573025	0.20334853	0.021134796	0	0.000957307	2.194045182	0.0002114	7.584684753	0.000205	1.7516648	0.005884	0	0.0009112	0	0.000202	0.131015944	0.00104164	53.22218629	500.304678	0.250152339
	Wise	0.00284449	43.2602751	0.002882008	1.02273379	0.002100781	0	0.00476997	10.93226012	0.0012561	45.07188599	0.000413	3.53844835	0.004182	0	0.0146143	0	0.004798	3.105986903	0.02576141	1316.270799	1423.202389	0.711601195
	Young	0.00623586	94.8377712	0.006289085	2.23179784	0.004605458	0	0.010412491	23.8643103	0.0027258	97.81146064	0.000899	7.6938233	0.008883	0	0.0308739	0	0.010564	6.838451052	0.05673017	2898.609376	3131.88699	1.565943495
	Total	**1.12183722**	**17061.4165**	**1.172570094**	**416.108157**	**1.090766584**	**0**	**1.189130767**	**2725.360027**	**1.62936**	**58466.49914**	**1.542363**	**13206.7407**	**1.359386**	**0**	**1.2316428**	**0**	**1.221806**	**790.9457123**	**1.52878695**	**78112.86421**	**170779.9344**	**85.3899672**

Energy Savings by PCA (MWh)		15,208.46		354.87		0.00		2,291.89		35,883.11		8,562.67		0.00		0.00		647.36		51,094.67	

Table 16: 2010 Totalized OSD Electricity Savings from the 2000 IECC / IRC by PCA for Single-family Residences

PCA	Total Electricity Savings by PCA (MWh) 2010-TRY 1999
American Electric Power - West (ERCOT)/PCA	75.98
Austin Energy/PCA	2.14
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	13.87
Reliant Energy HL&P/PCA	202.91
San Antonio Public Service Bd /PCA	50.39
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	3.80
TXU Electric/PCA	303.88
El Paso Electric Co/PCA	0.16
Entergy Electric System/PCA	49.48
Total	702.62

Table 17: 2010 OSD NOx Reductions from the 2000 IECC / IRC by PCA for Single-family Residences by County Using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/ PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00957217	0.72731877	0.011806715	0.025288251	0.007069474	0	0.004263638	0.059120035	0.0710018	14.40729479	0.01614	0.813348384	0.006781	0	0.0051797	0	0.126288	0.47944233	0.008772	2.665529856	19.17734241	0.009588671
	Chambers	0.0218814	1.66260631	0.027103415	0.058051539	0.016160386	0	0.009125896	0.126540599	0.1658435	33.65205903	0.037677	1.898648734	0.015138	0	0.0096055	0	0.011582	0.04396885	0.015905	4.833274282	42.27514935	0.021137575
	Fort Bend	0.05569551	4.23189238	0.068987309	0.147760697	0.041133619	0	0.023228475	0.322088393	0.4221274	85.65581094	0.095902	4.832699743	0.038531	0	0.0244493	0	0.029479	0.11191552	0.040484	12.30230898	107.6044767	0.053802238
	Galveston	0.02755599	2.09377665	0.033893644	0.072595213	0.020351324	0	0.012791501	0.177368258	0.2014466	40.8764621	0.045813	2.308589428	0.019824	0	0.0167751	0	0.594657	2.25756517	0.028709	8.724222644	56.51057947	0.02825529
	Harris	0.07736057	5.87806099	0.09582276	0.205238297	0.057134232	0	0.032264145	0.447377921	0.5863312	118.9751619	0.133207	6.712577094	0.05352	0	0.0339599	0	0.040946	0.15544967	0.056232	17.0877981	149.461664	0.074730832
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00176365	0.13400671	0.003151138	0.006749275	0.001302533	0	0.005050143	0.070025793	0.0020858	0.423229371	0.000604	0.030440867	0.015958	0	0.0637888	0	0.000846	0.00321229	0.004013	1.219532705	1.887197006	0.000943599
	Dallas	0.00504555	0.38337446	0.005305276	0.011363123	0.003726366	0	0.008757286	0.121429424	0.0024131	0.489650517	0.000782	0.0394199	0.00931	0	0.033672	0	0.008209	0.03116548	0.044002	13.37137465	14.44777755	0.007223889
	Denton	0.00063576	0.04830656	0.001170951	0.002508004	0.000469535	0	0.001874207	0.025987945	0.0007854	0.159375379	0.000227	0.011423431	0.006096	0	0.0243999	0	0.00025	0.00095043	0.00114	0.346289962	0.594841715	0.000297421
	Tarrant	0.01557224	1.18322024	0.015705165	0.033638161	0.011500796	0	0.026002176	0.360548826	0.006807	1.381236575	0.002244	0.113070861	0.022184	0	0.0770985	0	0.02638	0.10014806	0.141667	43.04978682	46.22164954	0.023110825
	Ellis	0.00350282	0.26615381	0.003532723	0.007566575	0.002586991	0	0.005848935	0.081101928	0.0015312	0.310695641	0.000505	0.025434183	0.00499	0	0.0173426	0	0.005934	0.02252733	0.031867	9.683627956	10.39710741	0.005198554
	Johnson	0.00033718	0.02561953	0.000621017	0.001330127	0.00024902	0	0.000993991	0.013782783	0.0004166	0.084525202	0.00012	0.00605845	0.003233	0	0.0129406	0	0.000133	0.00050407	0.000604	0.183655902	0.315476057	0.000157738
	Kaufman	0.00649275	0.49333651	0.006548174	0.014025227	0.004795187	0	0.01084145	0.15032865	0.0028381	0.575898226	0.000936	0.047144211	0.009249	0	0.0321458	0	0.010999	0.04175613	0.059067	17.94934795	19.2718369	0.009635918
	Parker	0.00047595	0.03616406	0.000876616	0.001877584	0.000351511	0	0.0014031	0.019455528	0.000588	0.119314249	0.00017	0.008551999	0.004564	0	0.0182667	0	0.000187	0.00071153	0.000853	0.259245356	0.445320306	0.00022266
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00095027	0.07220411	0.000958382	0.002052715	0.000701818	0	0.001586741	0.022001911	0.0004154	0.084287736	0.000137	0.006899967	0.001354	0	0.0047048	0	0.00161	0.00611137	0.008645	2.627043867	2.820601679	0.001410301
	Hood	0.01232788	0.93670509	0.012433111	0.0266299	0.00910469	0	0.020584816	0.285431155	0.0053888	1.093466189	0.001776	0.089513387	0.017562	0	0.0610356	0	0.020884	0.07928296	0.112152	34.08068333	36.591712	0.018295856
	Hunt	0.00635121	0.48258183	0.006405424	0.013719479	0.004690653	0	0.010605108	0.147051502	0.0027763	0.56334371	0.000915	0.046116472	0.009048	0	0.031445	0	0.010759	0.04084585	0.05778	17.55805417	18.85171301	0.009425857
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03112811	2.36519643	0.048234164	0.103310504	0.0229895	0	0.084461674	1.171154176	0.0010637	0.215847284	1.065347	53.68507433	0.043667	0	0.0043501	0	0.000484	0.00183762	0.002333	0.708827151	58.2512475	0.029125624
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200761	0.15254356	0.076651484	0.164176235	0.00148271	0	0.134326688	1.862587535	0.0012416	0.251928699	0.003567	0.179773359	0.001066	0	0.0018623	0	0.000403	0.00153054	0.001842	0.559660887	3.172200816	0.0015861
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00446951	0.33960554	0.170648096	0.365503191	0.003300936	0	0.299049574	4.146651836	0.002764	0.560865239	0.007942	0.400226842	0.002372	0	0.0041461	0	0.000898	0.00340741	0.0041	1.245964981	7.062225044	0.003531113
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.00246935	0.18762796	0.094281013	0.201936101	0.001823727	0	0.165221279	2.290975082	0.0015271	0.309871274	0.004388	0.221120499	0.001311	0	0.0022907	0	0.000496	0.00188255	0.002265	0.688380611	3.901794083	0.001950897
	Travis	0.00050761	0.03856949	0.298194277	0.638688403	0.000374892	0	0.033779905	0.468395596	0.0003331	0.067597974	0.000902	0.045446668	0.00027	0	0.0004695	0	0.000103	0.00039043	0.000465	0.1413462	1.400434754	0.000700217
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22352453	16.9839848	0.00447587	0.009586657	0.165082827	0	0.007477478	0.10368347	0.001651	0.335015283	0.001598	0.080520832	0.04596	0	0.0071176	0	0.001581	0.00600147	0.008136	2.472423044	19.99121551	0.009995608
	San Patricio	0.05533089	4.2041871	0.001107949	0.002373065	0.040864326	0	0.001850962	0.025665632	0.0004087	0.082929121	0.000396	0.019931992	0.011377	0	0.0017619	0	0.000391	0.00148559	0.002014	0.612019454	4.94859196	0.002474296
Victoria Area	Victoria	0.02060475	1.56560357	0.002090584	0.004477723	0.015217528	0	0.003408874	0.0472678	0.0011319	0.229687342	0.000524	0.026408234	0.495811	0	0.0305841	0	0.00045	0.00170821	0.002128	0.646545364	2.52169824	0.001260849
Other ERCOT counties	Andrews	2.5653E-05	0.00194916	2.58716E-05	5.54132E-05	1.89456E-05	0	4.28342E-05	0.000593944	1.121E-05	0.002275356	3.7E-06	0.000186265	3.65E-05	0	0.000127	0	4.35E-05	0.00016498	0.000233	0.070917315	0.076142428	3.80712E-05
	Angelina	0.00032149	0.02442767	0.000324234	0.000694462	0.000237435	0	0.000536817	0.007443558	0.0001405	0.028515736	4.63E-05	0.002334357	0.000458	0	0.0015917	0	0.000545	0.00206756	0.002925	0.888766176	0.954249527	0.000477125
	Bosque	0.00093945	0.0713821	0.001730301	0.003706052	0.000693828	0	0.002769496	0.038402115	0.0011606	0.235507332	0.000335	0.016880284	0.009008	0	0.0360555	0	0.00037	0.00140445	0.001684	0.511709059	0.878991387	0.000439496
	Brazos	0.00191393	0.14542519	0.003525105	0.007550258	0.00141352	0	0.005642234	0.078235786	0.0023645	0.479793921	0.000682	0.034389833	0.018351	0	0.073455	0	0.000754	0.00286125	0.003431	1.042493643	1.790749874	0.000895375
	Calhoun	0.08852525	6.72638238	0.001772635	0.003796725	0.065379841	0	0.0029614	0.041063077	0.0006539	0.132680341	0.000633	0.031889684	0.018202	0	0.0028189	0	0.000626	0.00237684	0.003222	0.979184982	7.917374027	0.003958687
	Cameron	0.05467229	4.15414504	0.001094762	0.002344819	0.285623104	0	0.001828931	0.025360137	0.0004038	0.081942023	0.000391	0.019694743	0.011242	0	0.0017409	0	0.000387	0.00146791	0.00199	0.604734641	4.889689314	0.002444845
	Cherokee	0.003513	0.26692666	0.003542982	0.007588547	0.002594504	0	0.005865919	0.081337432	0.0015356	0.311597841	0.000506	0.025508039	0.005005	0	0.0173929	0	0.005951	0.02259274	0.031959	9.711747325	10.42729859	0.005213649
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.0013551	0.10296403	2.71346E-05	5.81183E-05	0.001000801	0	4.53316E-05	0.000628573	1.001E-05	0.002031003	9.69E-06	0.000488151	0.000279	0	4.315E-05	0	9.58E-06	3.6383E-05	4.93E-05	0.014988865	0.121195126	6.05976E-05
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00362926	0.27576105	0.003660242	0.007839702	0.002680373	0	0.006060061	0.08402943	0.0015864	0.321910691	0.000523	0.02635227	0.00517	0	0.0179686	0	0.006148	0.02334049	0.033017	10.03317381	10.77240744	0.005386204
	Fannin	0.00762852	0.57963484	0.007693632	0.016478631	0.005633999	0	0.012737922	0.176625327	0.0033346	0.676638901	0.001099	0.055391049	0.010867	0	0.0377689	0	0.012923	0.04906044	0.0694	21.08918991	22.6430191	0.01132151
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00377443	0.28679149	0.003806652	0.00815329	0.002787588	0	0.006302464	0.087390607	0.0016499	0.334787119	0.000544	0.027406361	0.005377	0	0.0186873	0	0.006394	0.0242741	0.034338	10.43450076	11.20330373	0.005601652
	Frio	0.01476384	1.12179549	0.001497957	0.003208405	0.010903753	0	0.002442547	0.033868602	0.0008111	0.164576926	0.000375	0.018922183	0.355262	0	0.0219143	0	0.000322	0.00122397	0.001525	0.46326649	1.806862066	0.000903431
	Grimes	0.00055442	0.04212662	0.001021149	0.002187151	0.000409467	0	0.001634436	0.022663262	0.0006849	0.138986211	0.000198	0.009962012	0.005316	0	0.0212784	0	0.000218	0.00082884	0.000994	0.301988489	0.518742587	0.000259371
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.239737	18.2158511	0.004800509	0.010281987	0.177056459	0	0.008019827	0.111203742	0.0017708	0.359314296	0.001714	0.086361093	0.049294	0	0.0076338	0	0.001695	0.00643676	0.008726	2.651750502	21.44119951	0.0107206
	Howard	0.00058508	0.04445599	0.000590075	0.001263854	0.000432108	0	0.000976955	0.013546553	0.0002558	0.051895869	8.43E-05	0.004248302	0.000833	0	0.0028967	0	0.000991	0.00376277	0.005323	1.617468089	1.736641425	0.000868321
	Jack	0.00217756	0.16545663	0.002196145	0.004703821	0.001608224	0	0.003636037	0.050417658	0.0009519	0.193146415	0.000314	0.015811362	0.003102	0	0.0107811	0	0.003689	0.01400429	0.01981	6.019904286	6.463444461	0.003231722
	Jones	0.04250012	3.22927183	0.000851025	0.001822771	0.031388236	0	0.00142174	0.01971399	0.0003139	0.063698563	0.000304	0.015309932	0.008739	0	0.0013533	0	0.000301	0.0011411	0.001547	0.470097342	3.801055525	0.001900528
	Lamar	0.00107998	0.08205977	0.001089199	0.002332905	0.000797614	0	0.001803327	0.025005112	0.0004721	0.095792783	0.000156	0.007841794	0.001539	0	0.005347	0	0.00183	0.00694556	0.009825	2.985628213	3.20560614	0.001602803
	Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Llano	0.00124346	0.09448137	0.047475864	0.101686336	0.000918351	0	0.083198331	1.15363653	0.000769	0.156037848	0.00221	0.111346774	0.00066	0	0.0011535	0	0.00025	0.00094797	0.001141	0.346638873	1.964775707	0.000982388
	McLennan	0.02303137	1.7499843	0.023227961	0.049750884	0.017009692	0	0.038457253	0.533252192	0.0100675	2.042850727	0.003319	0.167231954	0.03281	0	0.1140288	0	0.039015	0.14811912	0.209526	63.67069182	68.361881	0.03418094
	Milam	0.00165249	0.12556072	0.001666598	0.003569607	0.001220439	0	0.002759294	0.038260646	0.0007223	0.146573778	0.000238	0.01199883	0.002354	0	0.0081815	0	0.002799	0.01062749	0.015033	4.568348403	4.904939477	0.00245247
	Mitchell	0.01696145	1.28877607	0.017106233	0.036639042	0.012526789	0	0.028321847	0.392713617	0.0074142	1.504457571	0.002444	0.123157985	0.024163	0	0.0839765	0	0.028733	0.10908233	0.154305	46.89028578	50.3451124	0.025172556
	Nolan	0.00060327	0.04583827	0.000608422	0.001303151	0.000445544	0	0.001007331	0.013967758	0.0002637	0.053509476	8.69E-05	0.004380396	0.000859	0	0.0029868	0	0.001022	0.00387976	0.005488	1.667760317	1.790639132	0.00089532
	Palo Pinto	0.00307488	0.23363746	0.00566337	0.012130107	0.002270935	0	0.00906471	0.125692193	0.0037988	0.770828202	0.001096	0.055250081	0.029483	0	0.1180115	0	0.001211	0.00459683	0.005512	1.674851356	2.876986229	0.001438493
	Pecos	4.2262E-05	0.00321116	4.26225E-05	9.12912E-05	3.12122E-05	0	7.05678E-05	0.0009785	1.847E-05	0.003748562	6.09E-06	0.000306865	6.02E-05	0	0.0002092	0	7.16E-05	0.00027179	0.000384	0.116833565	0.125441738	6.27209E-05
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00035926	0.02729733	0.000406685	0.000871059	0.000265328	0	0.000358385	0.004969409	0.0015339	0.311243938	0.000356	0.017936072	0.000371	0	0.0009089	0	0.093323	0.35429483	0.001655	0.502820677	1.219433317	0.000609717
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tom Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upton	3.2238E-05	0.00244952	3.25131E-05	6.96384E-05	2.38092E-05	0	5.38302E-05	0.000746415	1.409E-05	0.002859462	4.65E-06	0.000234081	4.59E-05	0	0.0001596	0	5.46E-05	0.00020733	0.000293	0.089122477	0.095688926	4.78445E-05
	Ward	0.01980763	1.5050358	0.0199767	0.042787162	0.014628815	0	0.033074321	0.458611907	0.0086584	1.756909174	0.002854	0.143824191	0.028218	0	0.098068	0	0.033554	0.12738661	0.180198	54.75858863	58.79314348	0.029396572
	Webb	0.01418005	1.07743738	0.000283942	0.000608162	0.010472596	0	0.000474359	0.006577517	0.0001047	0.021252845	0.000101	0.005108115	0.002916	0	0.0004515	0	0.0001	0.00038072	0.000516	0.156846644	1.268211386	0.000634106
	Wharton	0.00015439	0.01173096	0.000191235	0.000409598	0.000114024	0	6.43902E-05	0.000892841	0.0011702	0.237441022	0.000266	0.013396419	0.000107	0	6.777E-05	0	8.17E-05	0.00031023	0.000112	0.034102448	0.298283522	0.000149142
	Wichita	0.00021984	0.01670425	0.000221719	0.000474891	0.000162364	0	0.000367089	0.00509009	9.61E-05	0.019499767	3.17E-05	0.001596291	0.000313	0	0.0010884	0	0.000372	0.00141385	0.002	0.607760342	0.65253948	0.00032627
	Wilbarger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wise	0.00291847	0.22175314	0.002955932	0.006331172	0.002155421	0	0.004892446	0.067839156	0.0012878	0.261303894	0.000424	0.021352418	0.004281	0	0.0149528	0	0.004924	0.0186949	0.026441	8.034742088	8.632016771	0.004316008
	Young	0.00549666	0.41765078	0.005543579	0.011873533	0.004059529	0	0.009178198	0.127265824	0.0024027	0.487546204	0.000792	0.039911533	0.00783	0	0.0272141	0	0.009311	0.03535007	0.050005	15.19563015	16.31522809	0.008157614
	Total	**1.14303735**	**86.851002**	**1.154658244**	**2.473108594**	**1.089429227**	**0**	**1.180868675**	**16.37404528**	**1.5393506**	**312.3567076**	**1.443965**	**72.76444958**	**1.481727**	**0**	**1.2697054**	**0**	**1.151969**	**4.37335514**	**1.517783**	**461.2234777**	**956.4161459**	**0.478208073**

Energy Savings by PCA (MWh)																					
		75.98		2.14		0.00		13.87		202.91		50.39		0.00		0.00		3.80		303.88	

6.1.2 2010 Results for New Multi-family Residential Construction

In this section of the report, calculations are provided regarding the potential electricity reductions and associated emissions reductions from the implementation of the 2000 IECC/IRC to new multi-family residences in all the counties in ERCOT region as well as the 41 non-attainment and affected counties. To calculate the NOx emissions reductions from the implementation of the 2000 IECC/IRC in multi-family residences, new construction activity by county had to be determined. Energy savings attributable to the 2000 IECC/IRC then had to be modeled using the code-traceable, DOE-2 simulation that the Laboratory developed for the TERP. Next, these estimates were applied to the NAHB's survey data to determine the appropriate number of housing types. In addition, estimates of the NOx reduction potential from the electricity reductions in each county were calculated using the US EPA's 2007 eGRID database[28].

In Table 18 and Table 19, the 1999 and the 2000 IECC/IRC code-compliant building characteristics for multi-family are shown for each county. The 2000 IECC/IRC code-compliant characteristics are the minimum building code characteristics required by the 2000 IECC/IRC for each county for multi-family residences (i.e., Type A.2). In Table 18 and Table 19, the rows are sorted first by the US EPA's non-attainment and affected designation, then alphabetically. The fourth column in Table 18 and Table 19 list the window area for the average house as defined by the NAHB survey[29]. The fifth, sixth, seventh, and eighth columns show the NAHB's average glazing U-value, Solar Heat Gain Coefficient (SHGC), roof insulation and wall insulation, respectively. In columns nine through thirteen of Table 18 and Table 19, the corresponding values from the 2000 IECC/IRC code-compliant house are listed for each county (i.e., percent area, glazing U-value, SHGC, roof and wall insulation R-value). For each county the identical window percent area was used for the 1999 and code-compliant calculation (i.e., window-to-wall area).

The 2000 IECC/IRC SHGC is 0.4 for all non-attainment and affected counties since they all fall below the 3,500 HDD65, as required by the 2000 IECC/IRC. All houses were assumed to have an air conditioner efficiency[30] equal to a SEER 11, and furnace efficiency (AFUE) of 0.80. The values shown in Table 18 and Table 19 represent the only changes that were made to the simulation to obtain the savings calculations. All other variables in the simulation remained the same for the 1999 and the 2000 IECC/IRC code-compliant simulation. In cases where the 1999 values were more efficient than the 2000 IECC/IRC code-compliant simulation, the 1999 values were used in both simulations, since this indicates that the prevailing practice is already above code.

In Table 20 and Table 21, the code-traceable simulation results for multi-family are shown for each county. In a similar fashion as Table 18 and Table 19, the tables are first divided into US EPA affected and then non-attainment classifications, followed by an alphabetical listing of counties. In the third column, the 2000 IECC/IRC climate zone is listed followed by the number of projected new housing units[31] in the fourth column. In the fifth column, the total simulated energy use is listed if all new construction had been built to pre-code specifications, and, in the sixth column, the total county-wide energy use for code-compliant construction is shown. In a similar fashion as the 2009 report, the values in the fifth and sixth columns come from the associated tables in the 2010 Volume III Appendix to the 2010 Volume II Technical report. As previously explained, in the 2010 report, 144 simulations were run for each county, which were then distributed according to the NAHB's survey data to account for 1, 2 or 3 story, and 3 fuel options (i.e., central air conditioning with electric resistance heating, heat pump heating, or a natural gas-fired furnace).

In the seventh and eighth columns, the total pre-code and code-compliant peak-day energy use is reported for peak OSD, Episode Day for the 2010 annual report across all counties. In a similar fashion as the annual pre-code and code-compliant energy use, these values are from the associated tables for each county in the Volume III Appendix to this report.

In the ninth and tenth columns, the total annual electricity and Ozone Season Day savings are shown for each county, respectively. In similar fashion as the 2009 report, a 7% transmission and distribution loss is used in the 2010 report, which represents a fixed 1.07 multiplier for the electricity use. In the eleventh and twelfth columns, the

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[28] This analysis assumes transmission and distribution losses of 7%. Counties were assigned to utility service districts as indicated in a fashion similar to the 2009 report.

[29] In a similar fashion as single-family, this value represents the NAHB's reported number of window units times an average window size of 3 x 5 feet, which was determined by surveying local building suppliers. Additional information about the procedures used to determine these values can be found in the MS thesis by Im (2003).

[30] In a similar fashion as single-family, the choice of a SEER 11 efficiency for the air conditioner was based on ARI sales numbers for Texas which show an average SEER 11 for houses built in 1999.

[31] The number of projected new housing units uses the published values for the new housing units in 2010. A vacancy rate of 0% was assumed for 2010 calculations, based on information suggested by the Real Estate Center at Texas A&M University.

total annual pre-code and code-compliant natural gas use is shown for those residences that had natural gas-fired furnaces and domestic water heaters. Similarly, in columns thirteen and fourteen, the simulated total peak OSD natural gas use on the OSD, is shown for each county. Finally, in columns fifteen and sixteen, the total annual and peak-day natural gas savings are shown for each county.

In Table 22, the annual electricity savings from Table 20 and Table 21 are assigned to PCA provider(s) in a similar fashion as the single-family residential assignments. The total electricity savings for each PCA, as shown in Table 22 and Table 24, are then entered into the bottom row of Table 23 and Table 25 respectively, the 2007 US EPA eGRID database for Texas. eGRID then proportions each MWh of electricity savings according to the 1999 measured data from the power plants assigned to that PCA. For each county in which there is a power plant, the lbs-NOx/MWh are calculated and displayed as NOx reductions (lbs) in the column adjacent to the PCA column. In a similar fashion as the single-family residences, adding across the rows then totals the NOx reductions in each county from multiple PCAs that have power plants in that county. Counties that do not show NOx reductions represent counties that do not have power plants in eGRID's database. Table 24, the PCA assignments for peak OSD reductions are shown for each county, and, in Table 25, the peak OSD NOx reductions are shown calculated with the 2007 eGRID.

Table 18: 1999 and the 2000 IECC/IRC Code-compliant Building Characteristics used in the DOE-2 Simulations for Multi-family Residential (1)

		Climate Zone	1999 Average					2000 IECC				
			Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)	Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)
Non-attainment	BRAZORIA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	CHAMBERS	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	COLLIN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	DALLAS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	DENTON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	EL PASO	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FORT BEND	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	GALVESTON	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	HARDIN	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	HARRIS	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	JEFFERSON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	LIBERTY	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	MONTGOMERY	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	ORANGE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	TARRANT	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	WALLER	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
Affected	BASTROP	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BEXAR	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	CALDWELL	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	COMAL	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	ELLIS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	GREGG	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	GUADALUPE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	HARRISON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HAYS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HENDERSON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HOOD	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HUNT	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	JOHNSON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	KAUFMAN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	NUECES	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	PARKER	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ROCKWALL	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	RUSK	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	SAN PATRICIO	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	SMITH	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	TRAVIS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	UPSHUR	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	VICTORIA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	WILLIAMSON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	WILSON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
ERCOT	ANDERSON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	ANDREWS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ANGELINA	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	ARANSAS	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	ARCHER	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ATASCOSA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	AUSTIN	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BANDERA	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BAYLOR	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	BEE	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	BELL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BLANCO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BORDEN	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	BOSQUE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BRAZOS	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BREWSTER	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BRISCOE	8	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	BROOKS	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	BROWN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	BURLESON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	BURNET	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CALHOUN	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	CALLAHAN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CAMERON	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	CHEROKEE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CHILDRESS	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CLAY	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	COKE	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	COLEMAN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	COLORADO	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	COMANCHE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CONCHO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	COOKE	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CORYELL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	COTTLE	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CRANE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CROCKETT	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	CROSBY	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	CULBERSON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	DAWSON	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	DE WITT	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	DELTA	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	DICKENS	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	DIMMIT	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	DUVAL	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	EASTLAND	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ECTOR	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	EDWARDS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	ERATH	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FALLS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	FANNIN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FAYETTE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	FISHER	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FOARD	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FRANKLIN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	FREESTONE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00

Table 19: 1999 and the 2000 IECC/IRC Code-compliant Building Characteristics used in the DOE-2 Simulations for Multi-family Residential (2)

		Climate Zone	1999 Average					2000 IECC				
			Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)	Area %	Glazing U-value (Btu/ hr-ft2-F)	SHGC	Roof Insulation (hr-ft2-F/Btu)	Wall Insulation (hr-ft2-F/Btu)
	FRIO	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	GILLESPIE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	GLASSCOCK	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	GOLIAD	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	GONZALES	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	GRAYSON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	GRIMES	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	HALL	8	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HAMILTON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HARDEMAN	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HASKELL	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HIDALGO	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	HILL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HOPKINS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HOUSTON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	HOWARD	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	HUDSPETH	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	IRION	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	JACK	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	JACKSON	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	JEFF DAVIS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	JIM HOGG	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	JIM WELLS	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	JONES	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	KARNES	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	KENDALL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	KENEDY	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	KENT	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	KERR	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	KIMBLE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	KING	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	KINNEY	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	KLEBERG	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	KNOX	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	LA SALLE	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	LAMAR	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	LAMPASAS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	LAVACA	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	LEE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	LEON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	LIMESTONE	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	LIVE OAK	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	LLANO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	LOVING	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MADISON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	MARTIN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MASON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MATAGORDA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	MAVERICK	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	MCCULLOCH	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MCLENNAN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MCMULLEN	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
ERCOT	MEDINA	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	MENARD	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MIDLAND	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MILAM	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	MILLS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	MITCHELL	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MONTAGUE	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	MOTLEY	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	NACOGDOCHES	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	NAVARRO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	NOLAN	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	PALO PINTO	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	PECOS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	PRESIDIO	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	RAINS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	REAGAN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	REAL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	RED RIVER	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	REEVES	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	REFUGIO	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	ROBERTSON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	RUNNELS	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	SAN SABA	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	SCHLEICHER	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	SCURRY	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	SHACKELFORD	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	SOMERVELL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	STARR	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	STEPHENS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	STERLING	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	STONEWALL	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	SUTTON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	TAYLOR	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	TERRELL	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	THROCKMORTON	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	TITUS	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	TOM GREEN	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	UPTON	5	7.5%	0.75	0.61	36.08	21.41	7.5%	0.70	0.40	19.00	11.00
	UVALDE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	VAL VERDE	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	VAN ZANDT	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WARD	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WASHINGTON	4	7.5%	0.75	0.61	36.08	21.41	7.5%	0.85	0.40	19.00	11.00
	WEBB	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	WHARTON	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	WICHITA	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WILBARGER	7	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WILLACY	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	WINKLER	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	WISE	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	YOUNG	6	7.5%	0.75	0.61	36.08	21.41	7.5%	0.55	0.40	30.00	13.00
	ZAPATA	2	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00
	ZAVALA	3	7.5%	0.75	0.61	36.08	21.41	7.5%	any	0.40	19.00	11.00

Table 20: 2010 Annual and OSD Electricity and Natural Gas Savings from Implementation of the 2000 IECC / IRC for Multi-family Residences (1)

2010Summary TRY 1999															
	County	Climate Zone	No. of Projected Units (2010)	Precode Total Annual Elec. Use (MWh/yr)	Code-compliant Total Annual Elec. Use (MWh/yr)	Precode OSD Elec. Use (MWh/day)	Code-compliant OSD Elec. Use (MWh/day)	Total Annual Elec. Savings (MWh/yr) w/ 7% of T&D Loss	Total OSD Elec. Savings (MWh/day) w/ 7% of T&D Loss	Precode Total NG Use (Therm/yr)	Code-compliant Total NG Use (Therm/yr)	Precode OSD NG Use (Therm/day)	Code-compliant OSD NG Use (Therm/day)	Total Annual NG Savings (Therm/yr)	Total OSD NG Savings (Therm/day)
Affected County	BASTROP	4	2	118	106	0.43	0.37	13.14	0.07	606	584	1.09	1.09	22.39	0.00
	BEXAR	4	1,502	86,106	77,891	307.70	264.34	8,789.74	46.39	474,935	453,045	824.38	824.38	21,890.31	0.00
	CALDWELL	4	29	1,713	1,535	0.00	0.00	190.57	0.00	0	0	0.00	0.00	0.00	0.00
	COMAL	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	ELLIS	5	10	631	567	2.29	1.94	69.33	0.38	4,110	3,877	5.55	5.55	233.13	0.00
	GREGG	6	278	17,984	15,706	65.52	53.88	2,437.27	12.45	118,146	106,037	154.40	154.40	12,109.00	0.00
	GUADALUPE	4	187	10,720	9,698	38.31	32.91	1,094.33	5.78	59,130	56,404	102.64	102.64	2,725.36	0.00
	HARRISON	6	51	3,289	2,877	11.93	9.83	441.13	2.25	21,844	19,564	28.33	28.33	2,280.05	0.00
	HAYS	5	1,250	73,894	66,195	272.07	230.83	8,237.23	44.12	378,542	364,993	682.11	682.11	13,548.98	0.00
	HENDERSON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	HOOD	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	HUNT	6	10	632	564	2.29	1.93	72.98	0.39	4,118	3,840	5.55	5.55	278.41	0.00
	JOHNSON	5	397	25,065	22,492	90.92	76.96	2,752.51	14.94	163,161	153,906	220.50	220.50	9,255.28	0.00
	KAUFMAN	6	2	127	113	0.46	0.39	14.66	0.08	822	767	1.11	1.11	55.68	0.00
	NUECES	3	300	18,476	16,200	65.33	55.01	2,435.61	11.05	85,637	81,247	159.55	159.55	4,390.44	0.00
	PARKER	6	3	190	169	0.69	0.58	21.99	0.12	1,234	1,150	1.67	1.67	83.51	0.00
	ROCKWALL	6	124	7,846	6,997	28.45	23.92	909.09	4.84	50,992	47,540	68.87	68.87	3,451.87	0.00
	RUSK	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	SAN PATRICIO	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	SMITH	5	65	4,186	3,683	15.15	12.58	537.67	2.76	27,917	25,302	36.10	36.10	2,615.12	0.00
	TRAVIS	5	1,257	74,307	66,566	273.59	232.12	8,283.36	44.37	380,662	367,037	685.93	685.93	13,624.86	0.00
	UPSHUR	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	VICTORIA	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	WILLIAMSON	5	48	2,838	2,542	10.45	8.86	316.31	1.69	14,536	14,016	26.19	26.19	520.28	0.00
	WILSON	4	30	1,720	1,556	6.15	5.28	175.56	0.93	9,486	9,049	16.47	16.47	437.22	0.00
Nonattainment County	BRAZORIA	3	332	19,946	17,566	71.53	60.02	2,546.25	12.32	103,365	96,486	185.49	185.49	6,879.17	0.00
	CHAMBERS	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	COLLIN	6	362	22,906	20,426	83.05	69.83	2,653.96	14.14	148,863	138,786	201.06	201.06	10,077.23	0.00
	DALLAS	5	2,743	173,181	155,407	628.21	531.71	19,017.99	103.25	1,127,333	1,063,386	1,523.50	1,523.50	63,947.69	0.00
	DENTON	6	609	38,536	34,363	139.71	117.47	4,464.80	23.79	250,435	233,482	338.25	338.25	16,953.14	0.00
	EL PASO	6	1,588	96,024	85,217	290.39	251.70	11,563.55	41.40	617,537	571,512	911.86	911.86	46,025.29	0.00
	FORT BEND	4	230	13,826	12,174	49.60	41.61	1,767.64	8.55	71,609	66,831	128.50	128.50	4,777.28	0.00
	GALVESTON	3	240	14,419	12,699	51.71	43.39	1,840.66	8.90	74,722	69,749	134.09	134.09	4,972.89	0.00
	HARDIN	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.00	0.00
	HARRIS	4	3,982	239,376	210,775	858.80	720.40	30,603.28	148.09	1,239,761	1,157,052	2,224.72	2,224.72	82,709.31	0.00
	JEFFERSON	4	152	9,173	8,069	32.84	27.55	1,181.02	5.66	47,833	44,907	85.75	85.75	2,925.91	0.00
	LIBERTY	4	76	4,573	4,025	16.41	13.76	586.22	2.83	23,651	22,087	42.46	42.46	1,564.31	0.00
	MONTGOMERY	4	209	12,564	11,063	45.08	37.81	1,606.25	7.77	65,070	60,729	116.77	116.77	4,341.10	0.00
	ORANGE	4	16	965	849	3.46	2.90	124.25	0.59	5,037	4,728	9.03	9.03	308.27	0.00
	TARRANT	5	886	55,938	50,197	202.91	171.74	6,142.89	33.35	364,133	343,478	492.10	492.10	20,655.36	0.00
	WALLER	4	50	3,006	2,647	10.78	9.05	384.27	1.86	15,567	14,529	27.93	27.93	1,038.54	0.00
ERCOT	ANDERSON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ANDREWS	6	40	2,605	2,321	7.35	6.35	303.75	1.07	20,286	18,707	23.66	23.66	**1,579**	**0.00**
	ANGELINA	5	80	4,807	4,263	16.34	13.84	581.89	2.67	32,514	29,304	45.89	45.89	**3,210**	**0.00**
	ARANSAS	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ARCHER	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ATASCOSA	3	2	115	104	0.41	0.35	11.67	0.06	632	604	1.10	1.10	**29**	**0.00**
	AUSTIN	4	3	180	159	0.65	0.54	23.06	0.11	934	872	1.68	1.68	**62**	**0.00**
	BANDERA	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BAYLOR	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BEE	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BELL	5	164	10,633	9,506	37.27	31.50	1,206.48	6.17	71,848	67,831	90.91	90.91	**4,018**	**0.00**
	BLANCO	5	16	946	847	3.48	2.95	105.44	0.56	4,845	4,672	8.73	8.73	**173**	**0.00**
	BORDEN	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BOSQUE	5	4	259	232	0.91	0.77	29.43	0.15	1,752	1,654	2.22	2.22	**98**	**0.00**
	BRAZOS	4	218	13,105	11,539	47.02	39.44	1,675.42	8.11	67,872	63,344	121.80	121.80	**4,528**	**0.00**
	BREWSTER	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BRISCOE	8	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BROOKS	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BROWN	5	4	259	232	0.91	0.77	29.43	0.15	1,752	1,654	2.22	2.22	**98**	**0.00**
	BURLESON	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	BURNET	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CALHOUN	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CALLAHAN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CAMERON	2	196	12,533	10,974	45.21	37.99	1,667.96	7.72	55,635	53,159	104.41	104.41	**2,476**	**0.00**
	CHEROKEE	5	14	841	746	2.86	2.42	101.83	0.47	5,690	5,128	8.03	8.03	**562**	**0.00**
	CHILDRESS	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CLAY	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COKE	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COLEMAN	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COLORADO	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COMANCHE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CONCHO	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	COOKE	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CORYELL	5	119	7,716	6,898	27.04	22.86	875.44	4.48	52,134	49,219	65.97	65.97	**2,915**	**0.00**
	COTTLE	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CRANE	5	24	1,563	1,403	4.41	3.83	171.34	0.63	12,181	11,421	14.20	14.20	**760**	**0.00**
	CROCKETT	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CROSBY	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	CULBERSON	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DAWSON	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DE WITT	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DELTA	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DICKENS	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DIMMIT	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	DUVAL	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	EASTLAND	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ECTOR	6	440	28,656	25,533	80.87	69.90	3,341.28	11.73	223,145	205,777	260.28	260.28	**17,368**	**0.00**
	EDWARDS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	ERATH	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FALLS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FANNIN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FAYETTE	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FISHER	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FOARD	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FRANKLIN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FREESTONE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**
	FRIO	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	**0**	**0.00**

Table 21: 2010 Annual and OSD Electricity and Natural Gas Savings from Implementation of the 2000 IECC /IRC for Multi-family Residences (2)

2010Summary TRY 1999															
	County	Climate Zone	No. of Projected Units (2010)	Precode Total Annual Elec. Use (MWh/yr)	Code-compliant Total Annual Elec. Use (MWh/yr)	Precode OSD Elec. Use (MWh/day)	Code-compliant OSD Elec. Use (MWh/day)	Total Annual Elec. Savings (MWh/yr) w/ 7% of T&D Loss	Total OSD Elec. Savings (MWh/day) w/ 7% of T&D Loss	Precode Total NG Use (Therm/yr)	Code-compliant Total NG Use (Therm/yr)	Precode OSD NG Use (Therm/day)	Code-compliant OSD NG Use (Therm/day)	Total Annual NG Savings (Therm/yr)	Total OSD NG Savings (Therm/day)
ERCOT	GILLESPIE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	GLASSCOCK	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	GOLIAD	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	GONZALES	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	GRAYSON	6	252	15,929	14,211	57.70	48.54	1,838.97	9.80	103,778	96,762	139.96	139.96	7,016	0.00
	GRIMES	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	HALL	8	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	HAMILTON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	HARDEMAN	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	HASKELL	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	HIDALGO	2	456	29,159	25,532	105.18	88.39	3,880.57	17.97	129,437	123,677	242.91	242.91	5,760	0.00
	HILL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	HOPKINS	6	6	380	339	1.38	1.16	43.99	0.23	2,467	2,300	3.33	3.33	167	0.00
	HOUSTON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	HOWARD	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	HUDSPETH	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	IRION	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	JACK	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	JACKSON	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	JEFF DAVIS	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	JIM HOGG	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	JIM WELLS	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	JONES	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KARNES	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KENDALL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KENEDY	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KENT	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KERR	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KIMBLE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KING	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KINNEY	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KLEBERG	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	KNOX	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	LA SALLE	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	LAMAR	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	LAMPASAS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	LAVACA	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	LEE	4	16	945	847	3.48	2.95	105.14	0.56	4,851	4,672	8.73	8.73	179	0.00
	LEON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	LIMESTONE	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	LIVE OAK	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	LLANO	5	2	118	106	0.44	0.37	13.18	0.07	606	584	1.09	1.09	22	0.00
	LOVING	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MADISON	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MARTIN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MASON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MATAGORDA	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MAVERICK	3	49	3,018	2,646	10.67	8.98	397.82	1.80	13,987	13,270	26.06	26.06	717	0.00
	MCCULLOCH	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MCLENNAN	5	160	10,374	9,274	36.36	30.73	1,177.06	6.02	70,096	66,176	88.70	88.70	3,920	0.00
	MCMULLEN	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MEDINA	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MENARD	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MIDLAND	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MILAM	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MILLS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MITCHELL	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MONTAGUE	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	MOTLEY	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	NACOGDOCHE	5	212	12,739	11,298	43.30	36.67	1,542.00	7.09	86,163	77,656	121.61	121.61	8,507	0.00
	NAVARRO	5	108	7,003	6,260	24.54	20.75	794.51	4.06	47,315	44,669	59.87	59.87	2,646	0.00
	NOLAN	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	PALO PINTO	6	80	5,372	4,775	16.20	13.81	639.07	2.56	41,458	38,251	45.31	45.31	3,207	0.00
	PECOS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	PRESIDIO	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	RAINS	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	REAGAN	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	REAL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	RED RIVER	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	REEVES	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	REFUGIO	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	ROBERTSON	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	RUNNELS	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	SAN SABA	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	SCHLEICHER	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	SCURRY	7	34	2,322	2,088	5.78	5.08	249.98	0.75	21,554	19,697	21.25	21.25	1,858	0.00
	SHACKELFORI	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	SOMERVELL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	STARR	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	STEPHENS	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	STERLING	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	STONEWALL	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	SUTTON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	TAYLOR	6	118	7,924	7,043	23.90	20.37	942.63	3.77	61,151	56,420	66.83	66.83	4,731	0.00
	TERRELL	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	THROCKMORT	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	TITUS	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	TOM GREEN	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	UPTON	5	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	UVALDE	4	2	115	104	0.41	0.35	11.70	0.06	632	603	1.10	1.10	29	0.00
	VAL VERDE	4	8	459	415	1.64	1.41	46.82	0.25	2,530	2,413	4.39	4.39	117	0.00
	VAN ZANDT	6	4	253	226	0.92	0.77	29.33	0.16	1,645	1,534	2.22	2.22	111	0.00
	WARD	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	WASHINGTON	4	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	WEBB	3	27	1,663	1,458	5.88	4.95	219.20	0.99	7,707	7,312	14.36	14.36	395	0.00
	WHARTON	3	8	463	413	1.66	1.41	53.67	0.27	2,531	2,356	4.44	4.44	175	0.00
	WICHITA	7	30	2,184	1,933	6.69	5.64	268.93	1.12	17,953	16,454	16.51	16.51	1,499	0.00
	WILBARGER	7	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	WILLACY	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	WINKLER	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	WISE	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	YOUNG	6	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	ZAPATA	2	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	ZAVALA	3	0	0	0	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0	0.00
	TOTAL		19,916					143,654	706.76					433,630	0

Table 22: 2010 Totalized Annual Electricity Savings from the 2000 IECC / IRC by PCA for Multi-family Residences

PCA	Total Electricity Savings by PCA (MWh) 2010 TRY 1999
American Electric Power - West(ERCOT)/PCA	10,010.20
Austin Energy/PCA	308.29
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	8,308.87
Reliant Energy HL&P/PCA	29,567.72
San Antonio Public Service Bd /PCA	10,152.17
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	509.47
TXU Electric/PCA	58,504.74
El Paso Electric Co/PCA	18.25
Entergy Electric System/PCA	9,941.32
Total	127,321.02

Table 23: 2010 Annual NOx Reductions from the 2000 IECC / IRC by PCA for Multi-family Residences by County using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00883113	88.4013673	0.010890729	3.35749564	0.006522185	0	0.003944232	32.77210377	0.0654443	1935.038486	0.014877	151.038229	0.006262	0	0.0048171	0	0.121275	61.78627245	0.00816387	477.6250918	2750.019046	1.375009523
	Chambers	0.02176222	217.844116	0.026955801	8.31018606	0.016072371	0	0.009076193	75.41289473	0.1649402	4876.906383	0.037472	380.425079	0.015056	0	0.0095532	0	0.011519	5.868405545	0.01581859	925.4626187	6490.229682	3.245114841
	Fort Bend	0.07043123	705.030473	0.087239726	26.8950777	0.052016606	0	0.029374182	244.0662154	0.5338124	15783.61483	0.121275	1231.20734	0.048726	0	0.030918	0	0.037279	18.9925017	0.05119528	2995.166273	21004.9727	10.50248635
	Galveston	0.03385674	338.912605	0.041710519	12.8589083	0.025004711	0	0.015351589	127.5543319	0.2495874	7379.729714	0.056747	576.105679	0.024143	0	0.0192972	0	0.567751	289.2537132	0.03283689	1921.113488	10645.52844	5.322764219
	Harris	0.06826733	683.369396	0.084559408	26.068764	0.050418468	0	0.028471701	236.5676217	0.5174117	15298.6853	0.117549	1193.38021	0.047229	0	0.0299681	0	0.036133	18.40898361	0.04962237	2903.143971	20359.62425	10.17981213
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00203914	20.4121431	0.003716345	1.14570944	0.001505992	0	0.005950953	49.44568346	0.0024815	73.37165206	0.000717	7.27962056	0.019166	0	0.0766809	0	0.000864	0.44039332	0.0040002	234.0306171	386.125819	0.193062909
	Dallas	0.00453947	45.4409971	0.004683963	1.44401574	0.003352602	0	0.00774211	64.3281735	0.0020856	61.66676784	0.000681	6.91423982	0.007503	0	0.026717	0	0.007525	3.833747531	0.04037045	2361.862874	2545.490816	1.272745408
	Denton	0.00047388	4.74363474	0.000872802	0.26907541	0.000349982	0	0.001396994	11.60743814	0.0005854	17.31022529	0.000169	1.7154173	0.004544	0	0.0181872	0	0.000187	0.095070394	0.00084941	49.69424045	85.43510171	0.042717551
	Tarrant	0.01216249	121.748935	0.012266309	3.78157243	0.008982543	0	0.020308652	168.7419204	0.0053165	157.1969161	0.001753	17.7917386	0.017326	0	0.0602168	0	0.020603	10.49689123	0.11064724	6473.387728	6953.145702	3.476572851
	Ellis	0.00327981	32.8315772	0.003307809	1.01976241	0.002422289	0	0.005476558	45.50399862	0.0014337	42.39070077	0.000473	4.79783119	0.004672	0	0.0162384	0	0.005556	2.830657152	0.02983782	1745.654106	1875.028634	0.937514317
	Johnson	0.00028606	2.86350153	0.000526868	0.16242773	0.000211267	0	0.000843297	7.00684575	0.0003534	10.44934094	0.000102	1.03551398	0.002743	0	0.0109787	0	0.000113	0.057389372	0.00051274	29.99799554	51.57301484	0.025786507
	Kaufman	0.00632545	63.3190213	0.006379446	1.96671506	0.004671629	0	0.010562096	87.75906923	0.002765	81.75475905	0.000911	9.2531033	0.009011	0	0.0313175	0	0.010715	5.45920896	0.05754527	3366.670715	3616.182592	1.808091296
	Parker	0.00021749	2.1771124	0.000400576	0.12349336	0.000160626	0	0.000641157	5.32728569	0.0002687	7.94460538	7.75E-05	0.78729845	0.002085	0	0.0083471	0	8.56E-05	0.043632983	0.00038984	22.8073941	39.21082235	0.019605411
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00081989	8.20730918	0.000826893	0.25492243	0.000605529	0	0.001369042	11.3751887	0.0003584	10.59691972	0.000118	1.19937229	0.001168	0	0.0040593	0	0.001389	0.707613841	0.00745892	436.3824161	468.7237423	0.234361871
	Hood	0.01252711	125.398829	0.012634039	3.89493964	0.009251829	0	0.020917482	173.80061	0.0054759	161.9094997	0.001805	18.3251146	0.017846	0	0.062022	0	0.021221	10.811576	0.11396431	6667.452479	7161.593048	3.580796524
	Hunt	0.00618756	61.9386737	0.006240374	1.92384089	0.004569788	0	0.010331844	85.84593134	0.0027047	79.97251444	0.000892	9.05138669	0.008815	0	0.0306347	0	0.010482	5.340198815	0.05629078	3293.27767	3537.350215	1.768675108
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03341375	334.478206	0.051775843	15.9619406	0.024677545	0	0.090663423	753.310464	0.0011418	33.76164247	1.143572	11609.7342	0.046874	0	0.0046695	0	0.00052	0.26471298	0.00250387	146.4879787	12893.99912	6.446999562
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200047	20.025069	0.076378745	23.5467528	0.001477434	0	0.133848731	1112.131504	0.0012371	36.57919518	0.003555	36.088894	0.001062	0	0.0018557	0	0.000402	0.204664498	0.00183516	107.3658386	1335.941918	0.667970959
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00450233	45.0692451	0.171901148	52.9952916	0.003325174	0	0.301245466	2503.008968	0.0027843	82.32664323	0.008001	81.2231511	0.00239	0	0.0041765	0	0.000904	0.460626349	0.0041303	241.6419784	3006.725903	1.503362952
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.0024586	24.61106	0.093870431	28.9392534	0.001815785	0	0.164501762	1366.823514	0.0015205	44.95628791	0.004369	44.3537016	0.001305	0	0.0022807	0	0.000494	0.251535225	0.00225544	131.9539572	1641.889309	0.820944655
	Travis	0.00051001	5.10527029	0.299602906	92.3643821	0.000376663	0	0.033939476	281.9986453	0.0003347	9.89657561	0.000906	9.19909399	0.000271	0	0.0004717	0	0.000103	0.052642212	0.00046734	27.3413572	425.9579667	0.212978983
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.00068596	6.86664269	0.00069182	0.21328077	0.000506616	0	0.001145408	9.51704811	0.0002999	8.865909608	9.88E-05	1.00345446	0.000977	0	0.0033962	0	0.001162	0.592024901	0.00624051	365.0992136	392.1575741	0.196078787
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	2278.00765	0.004556851	1.40482868	0.168069652	0	0.007612767	63.25348097	0.0016809	49.70002144	0.001627	16.5155084	0.046792	0	0.0072464	0	0.001609	0.819958496	0.00828339	484.6178453	2894.319297	1.447159648
	San Patricio	0.05031335	503.646522	0.001007478	0.31059469	0.037158653	0	0.001683113	13.98476235	0.0003716	10.98821722	0.00036	3.65142687	0.010345	0	0.0016021	0	0.000356	0.181285275	0.00183138	107.1445444	639.9073523	0.319953676
Victoria Area	Victoria	0.02183674	218.59001	0.002215582	0.68304036	0.016127403	0	0.003612695	30.01740994	0.0011996	35.47006129	0.000555	5.63840113	0.525456	0	0.0324127	0	0.000477	0.242944748	0.00225485	131.9193617	422.5612294	0.211280615
Other ERCOT counties	Andrews	2.4742E-05	0.2476731	2.49533E-05	0.00769283	1.82731E-05	0	4.13138E-05	0.343270641	1.082E-05	0.31978471	3.57E-06	0.03619362	3.52E-05	0	0.0001225	0	4.19E-05	0.021353761	0.00022509	13.16877246	14.14474113	0.007072371
	Angelina	0.00031082	3.1113684	0.000313473	0.09664039	0.000229554	0	0.000519	4.312302838	0.0001359	4.017263202	4.48E-05	0.45467875	0.000443	0	0.0015389	0	0.000527	0.268254466	0.00282766	165.4313771	177.6918852	0.088845943
	Bosque	0.00059539	5.95998849	0.001096604	0.33807121	0.000439723	0	0.001755208	14.58379524	0.0007356	21.74888018	0.000212	2.15528132	0.005709	0	0.0228507	0	0.000234	0.119448162	0.00106721	62.43674262	107.3422072	0.053671104
	Brazos	0.00193973	19.41703	0.003572622	1.10140125	0.001432574	0	0.005718288	47.51250616	0.0023964	70.85561654	0.000692	7.02168506	0.018599	0	0.0744451	0	0.000764	0.389149838	0.00347685	203.412491	349.7098799	0.17485494
	Calhoun	0.08269981	827.841317	0.001655986	0.51052297	0.061077496	0	0.002766524	22.98668527	0.0006108	18.06127873	0.000591	6.00183244	0.017004	0	0.0026334	0	0.000585	0.297977717	0.00301023	176.1129619	1051.812576	0.525906288
	Cameron	0.04837175	484.210681	0.000968599	0.29860877	0.297964476	0	0.001618161	13.44508701	0.0003573	10.56417928	0.000346	3.51051743	0.009946	0	0.0015403	0	0.000342	0.174289433	0.00176071	103.0098107	615.2131739	0.307606587
	Cherokee	0.0035039	35.0747157	0.003533808	1.08943522	0.002587786	0	0.00585073	48.61294987	0.0015316	45.28694343	0.000505	5.12563147	0.004992	0	0.0173479	0	0.005936	3.024054993	0.03187642	1864.921724	2003.135455	1.001567727
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.00129879	13.0011116	2.6007E-05	0.00801768	0.000959212	0	4.34478E-05	0.361002108	9.593E-06	0.283649409	9.28E-06	0.09425779	0.000267	0	4.136E-05	0	9.19E-06	0.004679691	4.7275E-05	2.765825072	16.51854334	0.008259272
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00353575	35.3935278	0.003565928	1.09933765	0.002611307	0	0.005903911	49.05481791	0.0015456	45.69857968	0.000509	5.17222096	0.005037	0	0.0175056	0	0.00599	3.05154218	0.03216616	1881.872954	2021.34298	1.01067149
	Fannin	0.00705631	70.6350951	0.007116546	2.19395535	0.005211403	0	0.011782473	97.89902121	0.0030845	91.20095462	0.001017	10.3222352	0.010052	0	0.034936	0	0.011954	6.089982704	0.06419422	3755.666173	4034.007418	2.017003709
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00367718	36.8092689	0.003708565	1.14331116	0.00271576	0	0.006140067	51.01701062	0.0016074	47.52652287	0.00053	5.3791098	0.005238	0	0.0182058	0	0.006229	3.173603867	0.03345281	1957.147872	2102.196699	1.05109835
	Frio	0.00858833	85.9709156	0.000871383	0.2686381	0.006342868	0	0.001420864	11.8057738	0.0004718	13.95028822	0.000218	2.21756935	0.206661	0	0.0127478	0	0.000188	0.095549574	0.00088683	51.88356183	166.1922965	0.083096148
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.18852746	1887.19684	0.003775086	1.16381885	0.139235931	0	0.006306735	52.40182975	0.0013925	41.17357689	0.001348	13.6821381	0.038764	0	0.0060032	0	0.001333	0.67928792	0.00686231	401.4776963	2397.775185	1.198887592
	Howard	0.00055511	5.55679056	0.000559851	0.17259622	0.000409976	0	0.000926915	7.701615688	0.0002427	7.174685652	8E-05	0.81203967	0.000791	0	0.0027484	0	0.00094	0.479092699	0.00505009	295.4544097	317.3512302	0.158675615
	Jack	0.00212145	21.2361167	0.002139557	0.65960259	0.001566784	0	0.003542346	29.43289074	0.0009273	27.41914781	0.000306	3.10333258	0.003022	0	0.0105033	0	0.003594	1.830925308	0.0192997	1129.123772	1212.805788	0.606402894
	Jones	0.04071872	407.602401	0.000815354	0.25136507	0.030072592	0	0.001362147	11.31790347	0.0003008	8.892791929	0.000291	2.95510898	0.008372	0	0.0012966	0	0.000288	0.146714631	0.00148214	86.71235018	517.8786354	0.258939318
	Lamar	0.00095084	9.51807346	0.000958954	0.29563531	0.000702236	0	0.001587687	13.19188533	0.0004156	12.28932139	0.000137	1.39092038	0.001355	0	0.0047076	0	0.001611	0.820624685	0.00865017	506.0757184	543.5821789	0.271791089
	Limestone	0.00071976	7.20490667	0.000891528	0.27484844	0.000531572	0	0.000300183	2.494181981	0.0054552	161.2297432	0.001239	12.5820575	0.000498	0	0.000316	0	0.000381	0.19408977	0.00052318	30.60845491	214.6557825	0.107327891
	Llano	0.00123817	12.3943643	0.047274044	14.5740837	0.000914447	0	0.082844655	688.3453433	0.0007657	22.64041489	0.0022	22.3369467	0.000657	0	0.0011486	0	0.000249	0.126675536	0.00113586	66.45326995	826.8710983	0.413435549
	McLennan	0.02453432	245.593331	0.024743738	7.62823073	0.018119687	0	0.040966843	340.3881129	0.0107245	317.0993995	0.003535	35.8896966	0.034951	0	0.1214699	0	0.041562	21.17444786	0.22319886	13058.19104	14025.96426	7.012982128
	Milam	0.0022454	22.4769439	0.002264571	0.6981432	0.001658332	0	0.003749326	31.15265585	0.0009815	29.02124982	0.000324	3.28466044	0.003199	0	0.011117	0	0.003804	1.937906354	0.02042738	1195.098524	1283.670084	0.641835042
	Mitchell	0.01494317	149.584052	0.015070721	4.6461427	0.011036196	0	0.024951762	207.320911	0.006532	193.1364049	0.002153	21.8594138	0.021288	0	0.073984	0	0.025314	12.89676594	0.1359442	7953.380154	8542.823845	4.271411922
	Nolan	0.00056465	5.6522944	0.000569473	0.17556261	0.000417022	0	0.000942846	7.833982354	0.0002468	7.297996041	8.14E-05	0.82599609	0.000804	0	0.0027956	0	0.000957	0.487326803	0.00513689	300.5323461	322.8055044	0.161402752
	Palo Pinto	0.003207	32.1026829	0.005906709	1.82097545	0.002368511	0	0.009454195	78.55366738	0.003962	117.1474415	0.001144	11.6091353	0.03075	0	0.1230821	0	0.001263	0.64339159	0.00574838	336.3071841	578.1844782	0.289092239
	Pecos	4.0968E-05	0.41009451	4.13174E-05	0.01273771	3.02565E-05	0	6.84069E-05	0.5683839	1.791E-05	0.529496144	5.9E-06	0.05992902	5.84E-05	0	0.0002028	0	6.94E-05	0.035357331	0.0003727	21.80471427	23.42071288	0.011710356
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00073771	7.3845992	0.000835096	0.25745132	0.00054483	0	0.000735917	6.114638078	0.0031497	93.12879151	0.000731	7.41996982	0.000761	0	0.0018663	0	0.191633	97.63152518	0.00339774	198.7837399	410.720715	0.205360358
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.00569644	57.0224562	0.005745061	1.77114114	0.004207073	0	0.009511781	79.03213884	0.00249	73.62490879	0.000821	8.33295694	0.008115	0	0.0282032	0	0.00965	4.916334736	0.05182285	3031.882513	3256.58245	1.628291225
	Tom Green	0.00148245	14.839596	2.96846E-05	0.00915146	0.001094854	0	4.95918E-05	0.412051338	1.095E-05	0.323760211	1.06E-05	0.10758676	0.000305	0	4.72E-05	0	1.05E-05	0.005341445	5.396E-05	3.156939798	18.85442698	0.009427213
	Upton	3.1166E-05	0.31197905	3.14322E-05	0.0096902	2.30176E-05	0	5.20405E-05	0.432397568	1.362E-05	0.402813741	4.49E-06	0.04559095	4.44E-05	0	0.0001543	0	5.28E-05	0.02689806	0.00028353	16.58791785	17.81728741	0.008908644
	Ward	0.01855953	185.784524	0.01871795	5.77054438	0.013707039	0	0.030990277	257.4941399	0.0081128	239.876876	0.002674	27.1495573	0.02644	0	0.0918886	0	0.03144	16.01788086	0.16884373	9878.158322	10610.25184	5.305125922
	Webb	0.02001433	200.347344	0.000400768	0.12355257	0.014781473	0	0.000669531	5.563048434	0.0001478	4.371042071	0.000143	1.4525141	0.004115	0	0.0006373	0	0.000142	0.072114115	0.00072851	42.62140998	254.5510252	0.127275513
	Wharton	0.00014434	1.4448687	0.000178787	0.05511798	0.000106601	0	6.01986E-05	0.500182118	0.001094	32.34647564	0.000249	2.52320007	9.99E-05	0	6.336E-05	0	7.64E-05	0.038922674	0.00010492	6.138205596	43.04697278	0.021523486
	Wichita	0.00020763	2.07844919	0.000209406	0.06455749	0.000153346	0	0.000346701	2.880694653	9.076E-05	2.683602952	2.99E-05	0.30373345	0.000296	0	0.001028	0	0.000352	0.179198733	0.00188893	110.5110892	118.7013256	0.059350663
	Wilbarger	0.02861682	286.459966	0.000573025	0.17665752	0.021134796	0	0.000957307	7.954139211	0.0002114	6.24978868	0.000205	2.07682883	0.005884	0	0.0009112	0	0.000202	0.103109962	0.00104164	60.94080114	363.9612912	0.181980646
	Wise	0.00284449	28.4738787	0.002882008	0.88849236	0.002100781	0	0.00476997	39.63305751	0.0012561	37.13928423	0.000413	4.19529557	0.004182	0	0.0146143	0	0.004798	2.444421502	0.02576141	1507.164636	1619.939066	0.809969533
	Young	0.00623586	62.4221457	0.006289085	1.93885774	0.004605458	0	0.010412491	86.51601522	0.0027258	80.59675245	0.000899	9.1220387	0.008883	0	0.0308739	0	0.010564	5.381882575	0.05673017	3318.983865	3564.961557	1.782480779
	Total	1.12183722	11229.8108	1.172570094	361.49086	1.090766584	0	1.189130767	9880.331198	1.62936	48176.46038	1.542363	15658.3268	1.359386	0	1.2316428	0	1.221806	622.4767735	1.52878695	89441.28109	175370.1779	87.68508895

Energy Savings by PCA (MWh)																					
		10,010.20		308.29		0.00		8,308.87		29,567.72		10,152.17		0.00		0.00		509.47		58,504.74	

Table 24: 2010 Totalized OSD Electricity Savings from the 2000 IECC / IRC by PCA for Multi-family Residences

PCA	Total Electricity Savings by PCA (MWh) 2010 TRY 1999
American Electric Power - West(ERCOT)/PCA	44.68
Austin Energy/PCA	1.64
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	44.47
Reliant Energy HL&P/PCA	143.12
San Antonio Public Service Bd /PCA	53.55
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	2.60
TXU Electric/PCA	303.30
El Paso Electric Co/PCA	0.09
Entergy Electric System/PCA	48.12
Total	641.58

Table 25: 2010 OSD NOx Reductions from the 2000 IECC / IRC by PCA for Multi-family Residences by County using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/ PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00957217	0.42772074	0.011806715	0.019377408	0.007069474	0	0.004263638	0.189613632	0.0710018	10.1618228	0.01614	0.864335353	0.006781	0	0.0051797	0	0.126288	0.32877554	0.008772	2.66042185	14.65206731	0.007326034
	Chambers	0.0218814	0.9777435	0.027103415	0.044482646	0.016160386	0	0.009125896	0.405849262	0.1658435	23.73563292	0.037677	2.017670724	0.015138	0	0.0096055	0	0.011582	0.03015145	0.015905	4.824012185	32.0355427	0.016017771
	Fort Bend	0.05569551	2.48868613	0.068987309	0.113223298	0.041133619	0	0.023228475	1.033022902	0.4221274	60.41517057	0.095902	5.135650747	0.038531	0	0.0244493	0	0.029479	0.07674559	0.040484	12.27873383	81.54123307	0.040770617
	Galveston	0.02755599	1.23130563	0.033893644	0.0556269	0.020351324	0	0.012791501	0.568867048	0.2014466	28.83118382	0.045813	2.453309672	0.019824	0	0.0167751	0	0.594657	1.54811571	0.028709	8.707504248	43.39591303	0.021697957
	Harris	0.07736057	3.45676297	0.09582276	0.157266157	0.057134232	0	0.032264145	1.434859652	0.5863312	83.91613624	0.133207	7.133373352	0.05352	0	0.0339599	0	0.040946	0.10659895	0.056232	17.05505242	113.2600497	0.056630025
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/Fort Worth Area	Collin	0.00176365	0.0788065	0.003151138	0.005171708	0.001302533	0	0.005050143	0.224591291	0.0020858	0.298514186	0.000604	0.032349136	0.015958	0	0.0637888	0	0.000846	0.00220281	0.004013	1.217195691	1.858831326	0.000929416
	Dallas	0.00504555	0.22545438	0.005305276	0.008707121	0.003726366	0	0.008757286	0.389456368	0.0024131	0.345362669	0.000782	0.041891044	0.00931	0	0.033672	0	0.008209	0.0213716	0.044002	13.34575082	14.37799401	0.007188997
	Denton	0.00063576	0.02840806	0.001170951	0.001921787	0.000469535	0	0.001874207	0.083350232	0.0007854	0.112411412	0.000227	0.01213954	0.006096	0	0.0243999	0	0.00025	0.00065176	0.00114	0.34562636	0.58450915	0.000292255
	Tarrant	0.01557224	0.69582672	0.015705165	0.02577562	0.011500796	0	0.026002176	1.156375713	0.006807	0.974220457	0.002244	0.120159017	0.022184	0	0.0770985	0	0.02638	0.06867611	0.141667	42.96728968	46.00832331	0.023004162
	Ellis	0.00350282	0.15651941	0.003532723	0.005797973	0.002586991	0	0.005848935	0.260115392	0.0015312	0.219141351	0.000505	0.027028594	0.00499	0	0.0173426	0	0.005934	0.01544802	0.031867	9.665071033	10.34912177	0.005174561
	Johnson	0.00033718	0.0150663	0.000621017	0.001019225	0.00024902	0	0.000993991	0.044205041	0.0004166	0.059617724	0.00012	0.006438241	0.003233	0	0.0129406	0	0.000133	0.00034566	0.000604	0.183303959	0.309996151	0.000154998
	Kaufman	0.00649275	0.29012074	0.006548174	0.010746988	0.004795187	0	0.01084145	0.482143852	0.0028381	0.406195321	0.000936	0.050099575	0.009249	0	0.0321458	0	0.010999	0.02863409	0.059067	17.91495126	19.18289182	0.009591446
	Parker	0.00047595	0.02126732	0.000876616	0.00143872	0.000351511	0	0.0014031	0.062399038	0.000588	0.084155303	0.00017	0.009088104	0.004564	0	0.0182667	0	0.000187	0.00048793	0.000853	0.258748559	0.437584969	0.000218792
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00095027	0.0424617	0.000958382	0.001572916	0.000701818	0	0.001586741	0.070565964	0.0004154	0.059450233	0.000137	0.00733251	0.001354	0	0.0047048	0	0.00161	0.00419085	0.008645	2.622009612	2.807583789	0.001403792
	Hood	0.01232788	0.55085639	0.012433111	0.020405461	0.00910469	0	0.020584816	0.915453418	0.0053888	0.771248857	0.001776	0.095124778	0.017562	0	0.0610356	0	0.020884	0.05436795	0.112152	34.01537386	36.42283071	0.018211415
	Hunt	0.00635121	0.28379614	0.006405424	0.010512705	0.004690653	0	0.010605108	0.47163317	0.0027763	0.397340308	0.000915	0.04900741	0.009048	0	0.031445	0	0.010759	0.02800987	0.05778	17.52440733	18.76470693	0.009382353
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03112811	1.39092185	0.048234164	0.079162837	0.0229895	0	0.084461674	3.756202066	0.0010637	0.152242449	1.065347	57.05047007	0.043667	0	0.0043501	0	0.000484	0.00126014	0.002333	0.707468812	63.13772822	0.031568864
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200761	0.08970763	0.076651484	0.125801889	0.00148271	0	0.134326688	5.973812238	0.0012416	0.177691568	0.003567	0.191042943	0.001066	0	0.0018623	0	0.000403	0.00104956	0.001842	0.558588398	7.117694229	0.003558847
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00446951	0.19971481	0.170648096	0.280070937	0.003300936	0	0.299049574	13.29941225	0.002764	0.395592181	0.007942	0.425316157	0.002372	0	0.0041461	0	0.000898	0.00233662	0.0041	1.243577314	15.84602028	0.00792301
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.00246935	0.11034002	0.094281013	0.154735812	0.001823727	0	0.165221279	7.347764722	0.0015271	0.218559905	0.004388	0.234982042	0.001311	0	0.0022907	0	0.000496	0.00129095	0.002265	0.687061454	8.754734912	0.004377367
	Travis	0.00050761	0.0226819	0.298194277	0.489402183	0.000374892	0	0.033779905	1.50226891	0.0003331	0.04767853	0.000902	0.048295617	0.00027	0	0.0004695	0	0.000103	0.00026773	0.000465	0.141075335	2.251670205	0.001125835
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22352453	9.98792113	0.00447587	0.007345884	0.165082827	0	0.007477478	0.332540389	0.001651	0.236294599	0.001598	0.0855685	0.04596	0	0.0071176	0	0.001581	0.00411548	0.008136	2.467685092	13.12147108	0.006560736
	San Patricio	0.05533089	2.47239325	0.001107949	0.001818388	0.040864326	0	0.001850962	0.08231649	0.0004087	0.058491969	0.000396	0.021181483	0.011377	0	0.0017619	0	0.000391	0.00101874	0.002014	0.610846629	3.248066944	0.001624033
Victoria Area	Victoria	0.02060475	0.92069825	0.002090584	0.003431106	0.015217528	0	0.003408874	0.151600372	0.0011319	0.162004186	0.000524	0.028063706	0.495811	0	0.0305841	0	0.00045	0.0011714	0.002128	0.645306376	1.912275388	0.000956138
Other ERCOT counties	Andrews	2.5653E-05	0.00114626	2.58716E-05	4.2461E-05	1.89456E-05	0	4.28342E-05	0.001904935	1.121E-05	0.001604865	3.7E-06	0.000197942	3.65E-05	0	0.000127	0	4.35E-05	0.00011313	0.000233	0.070781415	0.075791008	3.78955E-05
	Angelina	0.00032149	0.0143654	0.000324234	0.00053214	0.000237435	0	0.000536817	0.023873466	0.0001405	0.020112857	4.63E-05	0.002480692	0.000458	0	0.0015917	0	0.000545	0.00141782	0.002925	0.887063016	0.949845391	0.000474923
	Bosque	0.00093945	0.0419783	0.001730301	0.002839804	0.000693828	0	0.002769496	0.123165767	0.0011606	0.166109169	0.000335	0.017938471	0.009008	0	0.0360555	0	0.00037	0.00096309	0.001684	0.510728461	0.863723063	0.000431862
	Brazos	0.00191393	0.08552147	0.003525105	0.00578547	0.00141352	0	0.005642234	0.250922916	0.0023645	0.338410568	0.000682	0.036545654	0.018351	0	0.073455	0	0.000754	0.00196209	0.003431	1.040495892	1.759644054	0.000879822
	Calhoun	0.08852525	3.95564278	0.001772635	0.002909283	0.065379841	0	0.0029614	0.131700178	0.0006539	0.09358274	0.000633	0.033888776	0.018202	0	0.0028189	0	0.000626	0.00162991	0.003222	0.97730855	5.196662216	0.002598331
	Cameron	0.05467229	2.44296457	0.001094762	0.001796744	0.285623104	0	0.001828931	0.081336684	0.0004038	0.057795744	0.000391	0.020929362	0.011242	0	0.0017409	0	0.000387	0.00100661	0.00199	0.603575776	3.209405495	0.001604703
	Cherokee	0.003513	0.15697391	0.003542982	0.005814809	0.002594504	0	0.005865919	0.260870717	0.0015356	0.219777695	0.000506	0.02710708	0.005005	0	0.0173929	0	0.005951	0.01549288	0.031959	9.693136515	10.3791736	0.005189587
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.0013551	0.06055096	2.71346E-05	4.45338E-05	0.001000801	0	4.53316E-05	0.002015999	1.001E-05	0.001432517	9.69E-06	0.000518752	0.000279	0	4.315E-05	0	9.58E-06	2.495E-05	4.93E-05	0.014960141	0.079547857	3.97739E-05
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00362926	0.16216922	0.003660242	0.00600726	0.002680373	0	0.006060061	0.269504668	0.0015864	0.227051605	0.000523	0.028004234	0.00517	0	0.0179686	0	0.006148	0.01600564	0.033017	10.01394704	10.72268967	0.005361345
	Fannin	0.00762852	0.34087095	0.007693632	0.012626937	0.005633999	0	0.012737922	0.566484269	0.0033346	0.47725022	0.001099	0.058863389	0.010867	0	0.0377689	0	0.012923	0.03364299	0.0694	21.04877629	22.53851505	0.011269258
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00377443	0.16865599	0.003806652	0.006247551	0.002787588	0	0.006302464	0.280284855	0.0016499	0.236133669	0.000544	0.029124403	0.005377	0	0.0186873	0	0.006394	0.01664586	0.034338	10.41450493	11.15159726	0.005575799
	Frio	0.01476384	0.65970413	0.001497957	0.002458476	0.010903753	0	0.002442547	0.108625591	0.0008111	0.116080193	0.000375	0.020108372	0.355262	0	0.0219143	0	0.000322	0.00083934	0.001525	0.462378723	1.370194817	0.000685097
	Grimes	0.00055442	0.02477377	0.001021149	0.001675929	0.000409467	0	0.001634436	0.072687093	0.0006849	0.098030426	0.000198	0.010586508	0.005316	0	0.0212784	0	0.000218	0.00056838	0.000994	0.301409783	0.509731885	0.000254866
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.239737	10.7123556	0.004800509	0.007878688	0.177056459	0	0.008019827	0.356659895	0.0017708	0.253433296	0.001714	0.091774874	0.049294	0	0.0076338	0	0.001695	0.00441398	0.008726	2.646668901	14.07318525	0.007036593
	Howard	0.00058508	0.02614363	0.000590075	0.000968442	0.000432108	0	0.000976955	0.043447389	0.0002558	0.036603445	8.43E-05	0.004514619	0.000833	0	0.0028967	0	0.000991	0.0025803	0.005323	1.614368503	1.728626325	0.000864313
	Jack	0.00217756	0.09730153	0.002196145	0.003604356	0.001608224	0	0.003636037	0.161702801	0.0009519	0.136230963	0.000314	0.01680254	0.003102	0	0.0107811	0	0.003689	0.00960338	0.01981	6.008368227	6.433613803	0.003216807
	Jones	0.04250012	1.89906626	0.000851025	0.001396719	0.031388236	0	0.00142174	0.063227995	0.0003139	0.044928178	0.000304	0.016269677	0.008739	0	0.0013533	0	0.000301	0.0007825	0.001547	0.469196485	2.494867813	0.001247434
	Lamar	0.00107998	0.04825761	0.001089199	0.001787614	0.000797614	0	0.001803327	0.080198027	0.0004721	0.067565029	0.000156	0.008333378	0.001539	0	0.005347	0	0.00183	0.00476289	0.009825	2.979906796	3.190811344	0.001595406
	Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Llano	0.00124346	0.05556249	0.047475864	0.0779183	0.000918351	0	0.083198331	3.70001833	0.000769	0.110057369	0.00221	0.118326851	0.00066	0	0.0011535	0	0.00025	0.00065007	0.001141	0.345974602	4.408508013	0.002204254
	McLennan	0.02303137	1.02912864	0.023227961	0.038122175	0.017009692	0	0.038457253	1.710281214	0.0100675	1.440873348	0.003319	0.177715346	0.03281	0	0.1140288	0	0.039015	0.10157205	0.209526	63.54867844	68.04637122	0.034023186
	Milam	0.00165249	0.0738396	0.001666598	0.002735252	0.001220439	0	0.002759294	0.12271204	0.0007223	0.103382126	0.000238	0.01275101	0.002354	0	0.0081815	0	0.002799	0.00728776	0.015033	4.559593988	4.882301769	0.002441151
	Mitchell	0.01696145	0.75790187	0.017106233	0.028075079	0.012526789	0	0.028321847	1.259536728	0.0074142	1.061131286	0.002444	0.13087848	0.024163	0	0.0839765	0	0.028733	0.07480275	0.154305	46.80042902	50.1127552	0.025056378
	Nolan	0.00060327	0.02695651	0.000608422	0.000998554	0.000445544	0	0.001007331	0.044798306	0.0002637	0.037741562	8.69E-05	0.004654993	0.000859	0	0.0029868	0	0.001022	0.00266053	0.005488	1.664564356	1.782374817	0.000891187
	Palo Pinto	0.00307488	0.13739724	0.00566337	0.009294831	0.002270935	0	0.00906471	0.4031282	0.0037988	0.543684273	0.001096	0.058713584	0.029483	0	0.1180115	0	0.001211	0.00315225	0.005512	1.671641806	2.827012184	0.001413506
	Pecos	4.2262E-05	0.00188842	4.26225E-05	6.99529E-05	3.12122E-05	0	7.05678E-05	0.003138308	1.847E-05	0.002643954	6.09E-06	0.000326102	6.02E-05	0	0.0002092	0	7.16E-05	0.00018638	0.000384	0.116609674	0.124862788	6.24314E-05
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00035926	0.01605298	0.000406685	0.000667459	0.000265328	0	0.000358385	0.015938213	0.0015339	0.219528079	0.000356	0.019060444	0.000371	0	0.0009089	0	0.093323	0.24295617	0.001655	0.501857112	1.016060461	0.00050803
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tom Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upton	3.2238E-05	0.00144051	3.25131E-05	5.33612E-05	2.38092E-05	0	5.38302E-05	0.002393951	1.409E-05	0.002016849	4.65E-06	0.000248755	4.59E-05	0	0.0001596	0	5.46E-05	0.00014217	0.000293	0.08895169	0.095247295	4.76236E-05
	Ward	0.01980763	0.88507962	0.0199767	0.032786145	0.014628815	0	0.033074321	1.470890024	0.0086584	1.23919167	0.002854	0.152840204	0.028218	0	0.098068	0	0.033554	0.08735483	0.180198	54.65365369	58.52179619	0.029260898
	Webb	0.01418005	0.63361807	0.000283942	0.000466011	0.010472596	0	0.000474359	0.021095841	0.0001047	0.014990159	0.000101	0.005428332	0.002916	0	0.0004515	0	0.0001	0.00026108	0.000516	0.156546075	0.832405564	0.000416203
	Wharton	0.00015439	0.00689873	0.000191235	0.000313859	0.000114024	0	6.43902E-05	0.002863577	0.0011702	0.16747305	0.000266	0.014236211	0.000107	0	6.777E-05	0	8.17E-05	0.00021274	0.000112	0.034037097	0.226035263	0.000113018
	Wichita	0.00021984	0.00982341	0.000221719	0.00036389	0.000162364	0	0.000367089	0.016325268	9.61E-05	0.01375367	3.17E-05	0.001696359	0.000313	0	0.0010884	0	0.000372	0.00096954	0.002	0.606595679	0.649527822	0.000324764
	Wilbarger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wise	0.00291847	0.13040832	0.002955932	0.004851332	0.002155421	0	0.004892446	0.217578165	0.0012878	0.184304125	0.000424	0.022690953	0.004281	0	0.0149528	0	0.004924	0.01281995	0.026441	8.019344956	8.591997799	0.004295999
	Young	0.00549666	0.24561156	0.005543579	0.009098228	0.004059529	0	0.009178198	0.408175253	0.0024027	0.343878445	0.000792	0.042413497	0.00783	0	0.0272141	0	0.009311	0.02424116	0.050005	15.16651047	16.23992861	0.008119964
	Total	1.14303735	51.0752318	1.154658244	1.895047317	1.089429227	0	1.180868675	52.51590608	1.5393506	220.3129427	1.443965	77.32588816	1.481727	0	1.2697054	0	1.151969	2.99900969	1.517783	460.3396262	866.4636519	0.433231826

Energy Savings by PCA (MWh)		44.68		1.64		0.00		44.47		143.12		53.55		0.00		0.00		2.60		303.30	

6.1.3 2010 Results for New Residential Construction (Single-family and Multi-family), Using 1999 Base Year and 2007 eGRID

In Table 26 andTable 27, the combined NOx emissions reductions are listed from single-family electricity savings, multi-family electricity savings, and natural gas savings (single-family and multi-family), which also show the 2010 annual and OSD electricity savings are shown for the combined single-family and multi-family savings.

Using the 2007 eGRID the total NOx reductions from electricity and natural gas savings from new construction in 2010 are 122.88 tons NOx/year, which represents 102.73 tons NOx/year (83.6%) from single-family residential electricity savings, 11.39 tons NOx/year (9.3%) from multi-family residential electricity savings, and 8.76 tons NOx/year (7.1%) from natural gas savings from single-family and multi-family residential. On a peak Ozone Season Day (OSD), the NOx reductions in 2010 are calculated to be 0.67 tons of NOx/day, which represents 0.59 tons NOx/day (88.1 %) from single-family residential electricity savings, 0.07 tons NOx/day (10.4%) from multi-family residential electricity savings, and 0.01 tons NOx/day (1.5 %) from natural gas savings from single-family and multi-family residential.

Figure 144 through Figure 149 show the electricity and NOx reductions tabulated in Table 26 and Table 27. Figure 144 shows the annual electricity savings by county as a stacked bar chart, and Figure 145 shows the OSD electricity savings by county in a similar fashion. Figure 146 shows the spatial distribution of the electricity savings by county across the state.

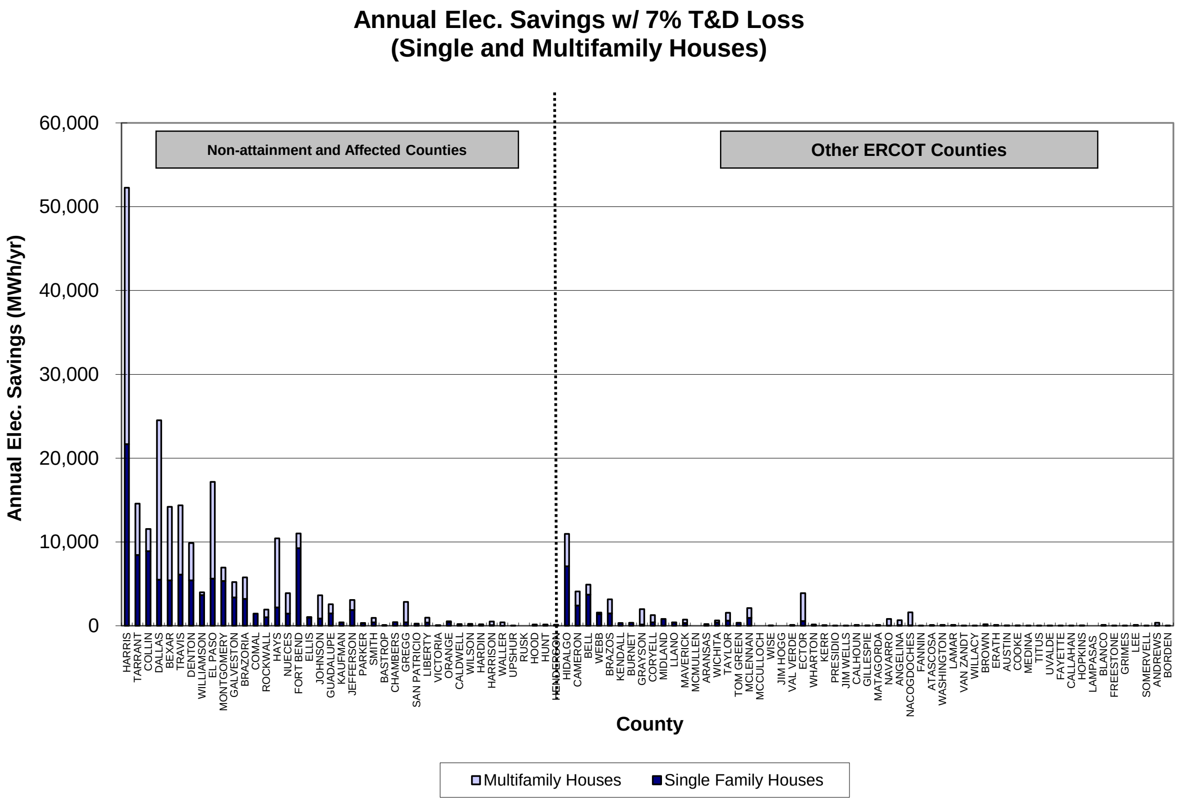
Figure 147 shows the annual NOx reductions in a similar format as the electricity savings using a stacked bar chart with the ordering of the counties determined by Table 26 and Table 27. Figure 148 shows the OSD NOx reductions, also as a stacked bar chart, and Figure 149 shows the spatial distribution of the NOx savings by county across the state.

Table 26: 2010 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences by County (Using 1999 Base year and 2007 eGRID) (1)

	Electricity Savings and Resultant NOx Reductions (Single Family Houses)				Electricity Savings and Resultant NOx Reductions (Multifamily Houses)				Total Electricity Savings and Resultant NOx Reductions (Single and Multi-Family Houses)				Total Natural Gas Savings and Resultant NOx Reductions (Single and Multi-Family Houses)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
HARRIS	21,663.68	13.51	122.48	0.09	30,603.28	1.40	148.09	0.01	52,266.96	14.91	270.5701	0.0993	208,002.40	0.96	116.7619	0.0005	15.87	0.0998
TARRANT	8,436.19	3.85	51.95	0.03	6,142.89	0.46	33.35	0.00	14,579.08	4.31	85.2965	0.0345	63,643.32	0.29	32.6825	0.0002	4.60	0.0346
COLLIN	8,897.03	0.21	53.62	0.00	2,653.96	0.02	14.14	0.00	11,550.99	0.23	67.7599	0.0013	61,143.63	0.28	32.4337	0.0001	0.52	0.0015
DALLAS	5,503.70	1.41	33.89	0.01	19,017.99	0.17	103.25	0.00	24,521.69	1.58	137.1416	0.0108	91,992.65	0.42	21.3218	0.0001	2.00	0.0109
BEXAR	5,412.25	6.67	31.86	0.04	8,789.74	0.94	46.39	0.01	14,201.99	7.61	78.2569	0.0418	45,904.89	0.21	24.5022	0.0001	7.83	0.0420
TRAVIS	6,101.39	0.16	37.00	0.00	8,283.36	0.02	44.37	0.00	14,384.75	0.18	81.3709	0.0010	32,464.30	0.15	24.4166	0.0001	0.33	0.0011
DENTON	5,414.86	0.05	32.62	0.00	4,464.80	0.01	23.79	0.00	9,879.66	0.05	56.4103	0.0004	52,083.11	0.24	19.9688	0.0001	0.29	0.0005
WILLIAMSON	3,670.55	0.00	22.26	0.00	316.31	0.00	1.69	0.00	3,986.86	0.00	23.9547	0.0000	11,853.94	0.05	14.6889	0.0001	0.05	0.0001
EL PASO	5,618.43	0.00	23.80	0.00	11,563.55	0.00	41.40	0.00	17,181.98	0.00	65.2045	0.0000	84,966.16	0.39	23.0247	0.0001	0.39	0.0001
MONTGOMERY	5,335.10	0.00	30.16	0.00	1,606.25	0.00	7.77	0.00	6,941.35	0.00	37.9356	0.0000	35,196.94	0.16	28.7549	0.0001	0.16	0.0001
GALVESTON	3,384.38	7.04	19.13	0.03	1,840.66	0.74	8.90	0.00	5,225.04	7.77	28.0363	0.0379	24,052.57	0.11	18.2794	0.0001	7.88	0.0380
BRAZORIA	3,220.15	1.82	18.20	0.01	2,546.25	0.19	12.32	0.00	5,766.40	2.01	30.5215	0.0128	25,032.97	0.12	17.3923	0.0001	2.12	0.0129
COMAL	1,453.11	0.00	8.56	0.00	0.00	0.00	0.00	0.00	1,453.11	0.00	8.5550	0.0000	6,447.58	0.03	6.5785	0.0000	0.03	0.0000
ROCKWALL	1,031.10	0.00	6.21	0.00	909.09	0.00	4.84	0.00	1,940.19	0.00	11.0556	0.0000	10,141.34	0.05	3.8025	0.0000	0.05	0.0000
HAYS	2,195.72	0.43	13.32	0.00	8,237.23	0.04	44.12	0.00	10,432.95	0.47	57.4374	0.0028	20,328.78	0.09	8.7869	0.0000	0.57	0.0028
NUECES	1,457.03	2.06	7.32	0.01	2,435.61	0.12	11.05	0.00	3,892.64	2.18	18.3612	0.0109	10,742.13	0.05	7.3814	0.0000	2.23	0.0110
FORT BEND	9,255.61	13.94	52.33	0.06	1,767.64	1.45	8.55	0.01	11,023.25	15.39	60.8818	0.0715	58,307.59	0.27	49.8854	0.0002	15.65	0.0717
ELLIS	977.50	1.04	6.02	0.01	69.33	0.12	0.38	0.00	1,046.83	1.16	6.3953	0.0078	5,214.13	0.02	3.7869	0.0000	1.19	0.0078
JOHNSON	877.14	0.03	5.40	0.00	2,752.51	0.00	14.94	0.00	3,629.65	0.03	20.3449	0.0002	13,724.88	0.06	3.3981	0.0000	0.09	0.0002
GUADALUPE	1,490.90	0.35	8.78	0.00	1,094.33	0.04	5.78	0.00	2,585.23	0.39	14.5535	0.0023	9,340.61	0.04	6.7496	0.0000	0.43	0.0023
KAUFMAN	394.31	2.00	2.38	0.01	14.66	0.24	0.08	0.00	408.97	2.24	2.4533	0.0144	2,613.82	0.01	1.4541	0.0000	2.25	0.0144
JEFFERSON	1,898.74	0.00	10.59	0.00	1,181.02	0.00	5.66	0.00	3,079.76	0.00	16.2460	0.0000	13,364.81	0.06	10.1270	0.0000	0.06	0.0000
PARKER	303.64	0.02	1.83	0.00	21.99	0.00	0.12	0.00	325.63	0.02	1.9462	0.0003	2,053.42	0.01	1.1197	0.0000	0.03	0.0003
SMITH	406.94	0.00	2.47	0.00	537.67	0.00	2.76	0.00	944.61	0.00	5.2278	0.0000	6,860.74	0.03	2.1226	0.0000	0.03	0.0000
BASTROP	59.43	0.79	0.37	0.00	13.14	0.08	0.07	0.00	72.57	0.87	0.4358	0.0051	276.36	0.00	0.3274	0.0000	0.87	0.0051
CHAMBERS	445.31	4.31	2.49	0.03	0.00	0.45	0.00	0.00	445.31	4.75	2.4874	0.0281	2,460.05	0.01	2.3866	0.0000	4.77	0.0281
GREGG	420.48	0.00	2.54	0.00	2,437.27	0.00	12.45	0.00	2,857.75	0.00	14.9846	0.0000	17,222.11	0.08	2.0909	0.0000	0.08	0.0000
SAN PATRICIO	262.64	0.46	1.32	0.00	0.00	0.03	0.00	0.00	262.64	0.48	1.3187	0.0027	1,144.94	0.01	1.3306	0.0000	0.49	0.0027
LIBERTY	379.61	0.00	2.14	0.00	586.22	0.00	2.83	0.00	965.83	0.00	4.9776	0.0000	3,751.30	0.02	2.0381	0.0000	0.02	0.0000
VICTORIA	79.98	0.27	0.46	0.00	0.00	0.02	0.00	0.00	79.98	0.29	0.4597	0.0015	600.29	0.00	0.4963	0.0000	0.30	0.0015
ORANGE	415.57	0.00	2.32	0.00	124.25	0.00	0.59	0.00	539.81	0.00	2.9119	0.0000	2,594.16	0.01	2.2176	0.0000	0.01	0.0000
CALDWELL	19.38	0.00	0.12	0.00	190.57	0.00	0.00	0.00	209.94	0.00	0.1176	0.0000	60.01	0.00	0.0778	0.0000	0.00	0.0000
WILSON	53.25	0.00	0.31	0.00	175.56	0.00	0.93	0.00	228.81	0.00	1.2401	0.0000	673.48	0.00	0.2411	0.0000	0.00	0.0000
HARDIN	172.08	0.00	0.96	0.00	0.00	0.00	0.00	0.00	172.08	0.00	0.9597	0.0000	947.01	0.00	0.9187	0.0000	0.00	0.0000
HARRISON	75.62	0.00	0.45	0.00	441.13	0.00	2.25	0.00	516.75	0.00	2.7003	0.0000	3,225.41	0.01	0.3802	0.0000	0.01	0.0000
WALLER	17.63	0.00	0.10	0.00	384.27	0.00	1.86	0.00	401.90	0.00	1.9592	0.0000	1,140.52	0.01	0.0950	0.0000	0.01	0.0000
UPSHUR	30.37	0.00	0.19	0.00	0.00	0.00	0.00	0.00	30.37	0.00	0.1884	0.0000	320.65	0.00	0.1584	0.0000	0.00	0.0000
RUSK	0.00	0.22	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.24	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.24	0.0000
HOOD	154.55	3.96	0.95	0.02	0.00	0.48	0.00	0.00	154.55	4.44	0.9517	0.0273	787.55	0.00	0.5988	0.0000	4.44	0.0273
HUNT	78.58	1.96	0.47	0.01	72.98	0.24	0.39	0.00	151.56	2.19	0.8624	0.0141	731.41	0.00	0.2877	0.0000	2.20	0.0141
HENDERSON	119.66	0.26	0.73	0.00	0.00	0.03	0.00	0.00	119.66	0.29	0.7253	0.0021	1,438.52	0.01	0.6336	0.0000	0.30	0.0021
HIDALGO	7,091.64	1.71	35.51	0.01	3,880.57	0.10	17.97	0.00	10,972.21	1.81	53.4780	0.0117	35,195.72	0.16	32.7466	0.0002	1.97	0.0119
CAMERON	2,428.68	0.44	12.16	0.00	1,667.96	0.03	7.72	0.00	4,096.64	0.46	19.8839	0.0027	12,556.66	0.06	11.2147	0.0001	0.52	0.0027
BELL	3,715.30		21.29		1,206.48		6.17		4,921.78	0.00	27.4604	0.0000	23,375.82	0.11	13.6080	0.0001	0.11	0.0001
WEBB	1,366.26	0.18	6.82	0.00	219.20	0.01	0.99	0.00	1,585.46	0.19	7.8095	0.0007	3,795.43	0.02	4.9455	0.0000	0.21	0.0007
BRAZOS	1,489.05	0.19	8.42	0.00	1,675.42	0.02	8.11	0.00	3,164.47	0.21	16.5260	0.0013	13,140.02	0.06	8.0256	0.0000	0.27	0.0013
KENDALL	345.14		2.03		0.00		0.00		345.14	0.00	2.0307	0.0000	1,575.69	0.01	1.5708	0.0000	0.01	0.0000
BURNET	367.25		2.23		0.00		0.00		367.25	0.00	2.2272	0.0000	1,133.97	0.01	1.4697	0.0000	0.01	0.0000
GRAYSON	159.29		0.96		1,838.97		9.80		1,998.26	0.00	10.7609	0.0000	7,934.22	0.04	0.5832	0.0000	0.04	0.0000
CORYELL	411.87		2.36		875.44		4.48		1,287.30	0.00	6.8385	0.0000	5,061.35	0.02	1.5085	0.0000	0.02	0.0000
MIDLAND	825.36		3.13		0.00		0.00		825.36	0.00	3.1281	0.0000	7,440.94	0.03	3.0637	0.0000	0.03	0.0000
LLANO	378.91	0.22	2.30	0.00	13.18	0.02	0.07	0.00	392.09	0.24	2.3685	0.0014	1,191.64	0.01	1.5163	0.0000	0.24	0.0014
MAVERICK	335.12		1.67		397.82		1.80		732.94	0.00	3.4758	0.0000	1,551.14	0.01	1.2131	0.0000	0.01	0.0000
MCMULLEN	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
ARANSAS	208.45		1.05		0.00		0.00		208.45	0.00	1.0466	0.0000	908.68	0.00	1.0560	0.0000	0.00	0.0000
WICHITA	383.46	0.07	1.68	0.00	268.93	0.01	1.12	0.00	652.39	0.07	2.8039	0.0005	5,056.32	0.02	1.1275	0.0000	0.10	0.0005
TAYLOR	612.15	0.00	2.66	0.00	942.63	0.00	3.77	0.00	1,554.78	0.00	6.4388	0.0000	9,973.97	0.05	2.0995	0.0000	0.05	0.0000
TOM GREEN	367.67	0.01	1.65	0.00	0.00	0.00	0.00	0.00	367.67	0.01	1.6458	0.0000	2,419.10	0.01	1.3764	0.0000	0.03	0.0000
MCLENNAN	938.38	7.76	5.38	0.04	1,177.06	0.93	6.02	0.01	2,115.44	8.69	11.3984	0.0510	8,809.11	0.04	3.4370	0.0000	8.74	0.0510
MCCULLOCH	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
WISE	66.13	0.90	0.40	0.01	0.00	0.11	0.00	0.00	66.13	1.00	0.3985	0.0064	379.54	0.00	0.2411	0.0000	1.01	0.0064
JIM HOGG	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
VAL VERDE	51.53		0.30		46.82		0.25		98.35	0.00	0.5505	0.0000	345.23	0.00	0.2333	0.0000	0.00	0.0000
ECTOR	561.41	1.12	2.13	0.01	3,341.28	0.13	11.73	0.00	3,902.69	1.25	13.8610	0.0080	22,429.73	0.10	2.0840	0.0000	1.36	0.0080
WHARTON	103.80	0.03	0.60	0.00	53.67	0.00	0.27	0.00	157.46	0.03	0.8657	0.0002	954.20	0.00	0.6442	0.0000	0.04	0.0002
KERR	79.67		0.48		0.00		0.00		79.67	0.00	0.4832	0.0000	245.99	0.00	0.3188	0.0000	0.00	0.0000
PRESIDIO	4.15	0.00	0.02	0.00	0.00	0.00	0.00	0.00	4.15	0.00	0.0186	0.0000	27.33	0.00	0.0156	0.0000	0.00	0.0000
JIM WELLS	37.52		0.19		0.00		0.00		37.52	0.00	0.1884	0.0000	163.56	0.00	0.1901	0.0000	0.00	0.0000
CALHOUN	95.29	0.75	0.55	0.00	0.00	0.04	0.00	0.00	95.29	0.79	0.5477	0.0043	715.24	0.00	0.5914	0.0000	0.80	0.0043
GILLESPIE	66.07		0.40		0.00		0.00		66.07	0.00	0.4007	0.0000	203.99	0.00	0.2644	0.0000	0.00	0.0000
MATAGORDA	115.71		0.67		0.00		0.00		115.71	0.00	0.6650	0.0000	868.50	0.00	0.7181	0.0000	0.00	0.0000
NAVARRO	21.23		0.12		794.51		4.06		815.74	0.00	4.1862	0.0000	2,756.50	0.01	0.0778	0.0000	0.01	0.0000
ANGELINA	74.01	0.10	0.42	0.00	581.89	0.01	2.67	0.00	655.89	0.11	3.0938	0.0007	4,049.54	0.02	0.4541	0.0000	0.13	0.0007
NACOGDOCHES	65.40		0.37		1,542.00		7.09		1,607.40	0.00	7.4587	0.0000	9,248.89	0.04	0.4013	0.0000	0.04	0.0000
FANNIN	2.12	2.23	0.01	0.01	0.00	0.27	0.00	0.00	2.12	2.50	0.0128	0.0169	12.24	0.00	0.0078	0.0000	2.50	0.0169
ATASCOSA	57.88		0.34		11.67		0.06		69.55	0.00	0.4030	0.0000	289.05	0.00	0.2644	0.0000	0.00	0.0000
WASHINGTON	105.80		0.60		0.00		0.00		105.80	0.00	0.5982	0.0000	611.90	0.00	0.5702	0.0000	0.00	0.0000
LAMAR	96.21	0.30	0.58	0.00	0.00	0.04	0.00	0.00	96.21	0.34	0.5768	0.0024	1,217.28	0.01	0.4858	0.0000	0.34	0.0024
VAN ZANDT	10.67		0.06		29.33		0.16		39.99	0.00	0.2206	0.0000	172.57	0.00	0.0389	0.0000	0.00	0.0000
WILLACY	36.59		0.18		0.00		0.00		36.59	0.00	0.1832	0.0000	151.88	0.00	0.1690	0.0000	0.00	0.0000
BROWN	146.49		0.84		29.43		0.15		175.92	0.00	0.9899	0.0000	861.25	0.00	0.5365	0.0000	0.00	0.0000
ERATH	102.02		0.44		0.00		0.00		102.02	0.00	0.4441	0.0000	873.84	0.00	0.3499	0.0000	0.00	0.0000
AUSTIN	35.27		0.20		23.06		0.11		58.32	0.00	0.3110	0.0000	266.28	0.00	0.1901	0.0000	0.00	0.0000
COOKE	55.22		0.33		0.00		0.00		55.22	0.00	0.3327	0.0000	318.32	0.00	0.2022	0.0000	0.00	0.0000
MEDINA	20.61		0.12		0.00		0.00		20.61	0.00	0.1213	0.0000	91.46	0.00	0.0933	0.0000	0.00	0.0000
TITUS	8.37	1.80	0.05	0.00	0.00	0.22	0.00	0.00	8.37	2.02	0.0502	0.0000	105.85	0.00	0.0422	0.0000	2.02	0.0000
UVALDE	17.18		0.10		11.70		0.06		28.88	0.00	0.1629	0.0000	105.36	0.00	0.0778	0.0000	0.00	0.0000
FAYETTE	9.80	0.00	0.06	0.00	0.00	0.00	0.00	0.00	9.80	0.00	0.0554	0.0000	56.66	0.00	0.0528	0.0000	0.00	0.0000
CALLAHAN	4.53		0.02		0.00		0.00		4.53	0.00	0.0197	0.0000	38.84	0.00	0.0156	0.0000	0.00	0.0000
HOPKINS	21.33		0.13		43.99		0.23		65.32	0.00	0.3630	0.0000	289.46	0.00	0.0778	0.0000	0.00	0.0000
LAMPASAS	#N/A		#N/A		0.00		0.00		#N/A	0.00	#N/A	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
BLANCO	9.72		0.06		105.44		0.56		115.15	0.00	0.6237	0.0000	203.43	0.00	0.0389	0.0000	0.00	0.0000
FREESTONE	19.11	1.16	0.11	0.01	0.00	0.14	0.00	0.00	19.11	1.30	0.1095	0.0084	99.56	0.00	0.0700	0.0000	1.30	0.0084
GRIMES	5.88	0.00	0.03	0.00	0.00	0.00	0.00	0.00	5.88	0.00	0.0332	0.0004	33.99	0.00	0.0317	0.0000	0.00	0.0004
LEE	7.75		0.05		105.14		0.56		112.89	0.00	0.6108	0.0000	203.11	0.00	0.0311	0.0000	0.00	0.0000
SOMERVELL	16.06		0.10		0.00		0.00		16.06	0.00	0.0989	0.0000	81.82	0.00	0.0622	0.0000	0.00	0.0000
ANDREWS	64.94	0.01	0.25	0.00	303.75	0.00	1.07	0.00	368.69	0.01	1.3128	0.0001	2,164.40	0.01	0.2411	0.0000	0.02	0.0001
BORDEN	36.86		0.12		0.00		0.00		36.86	0.00	0.1215	0.0000	650.06	0.00	0.2006	0.0000	0.00	0.0000

Table 27: 2010 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences by County (Using 1999 Base year and 2007 eGRID) (2)

	Electricity Savings and Resultant NOx Reductions (Single Family Houses)				Electricity Savings and Resultant NOx Reductions (Multifamily Houses)				Total Electricity Savings and Resultant NOx Reductions (Single and Multi-Family Houses)				Total Natural Gas Savings and Resultant NOx Reductions (Single and Multi-Family Houses)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
CHEROKEE	27.54	1.11	0.16	0.01	101.83	0.13	0.47	0.00	129.37	1.24	0.6240	0.0078	874.08	0.00	0.1690	0.0000	1.25	0.0078
DIMMIT	10.74		0.05		0.00		0.00		10.74	0.00	0.0536	0.0000	26.73	0.00	0.0389	0.0000	0.00	0.0000
FALLS	10.62		0.06		0.00		0.00		10.62	0.00	0.0608	0.0000	55.31	0.00	0.0389	0.0000	0.00	0.0000
COLORADO	13.71		0.08		0.00		0.00		13.71	0.00	0.0775	0.0000	79.32	0.00	0.0739	0.0000	0.00	0.0000
FRIO	18.73	0.11	0.11	0.00	0.00	0.01	0.00	0.00	18.73	0.12	0.1104	0.0011	84.21	0.00	0.0855	0.0000	0.12	0.0011
MILAM	5.93	0.71	0.03	0.00	0.00	0.09	0.00	0.00	5.93	0.80	0.0335	0.0037	19.51	0.00	0.0233	0.0000	0.80	0.0037
JACKSON	20.42		0.12		0.00		0.00		20.42	0.00	0.1174	0.0000	153.27	0.00	0.1267	0.0000	0.00	0.0000
ANDERSON	27.54		0.16		0.00		0.00		27.54	0.00	0.1559	0.0000	312.29	0.00	0.1690	0.0000	0.00	0.0000
HILL	19.11		0.11		0.00		0.00		19.11	0.00	0.1095	0.0000	99.56	0.00	0.0700	0.0000	0.00	0.0000
CULBERSON	5.63		0.02		0.00		0.00		5.63	0.00	0.0238	0.0000	39.02	0.00	0.0233	0.0000	0.00	0.0000
MASON	17.49		0.11		0.00		0.00		17.49	0.00	0.1061	0.0000	54.00	0.00	0.0700	0.0000	0.00	0.0000
PECOS	12.46	0.01	0.06	0.00	0.00	0.00	0.00	0.00	12.46	0.01	0.0558	0.0001	82.00	0.00	0.0467	0.0000	0.01	0.0001
RAINS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
LAVACA	15.30		0.09		0.00		0.00		15.30	0.00	0.0879	0.0000	116.77	0.00	0.0950	0.0000	0.00	0.0000
PALO PINTO	36.28	0.32	0.16	0.00	639.07	0.03	2.56	0.00	675.35	0.35	2.7169	0.0020	3,518.12	0.02	0.1244	0.0000	0.37	0.0020
KIMBLE	2.08		0.01		0.00		0.00		2.08	0.00	0.0093	0.0000	13.67	0.00	0.0078	0.0000	0.00	0.0000
MADISON	37.23		0.21		0.00		0.00		37.23	0.00	0.2105	0.0000	215.30	0.00	0.2006	0.0000	0.00	0.0000
ARCHER	31.73		0.14		0.00		0.00		31.73	0.00	0.1391	0.0000	294.41	0.00	0.0933	0.0000	0.00	0.0000
REFUGIO	5.10		0.03		0.00		0.00		5.10	0.00	0.0293	0.0000	38.32	0.00	0.0317	0.0000	0.00	0.0000
LIMESTONE	8.49	0.14	0.05	0.00	0.00	0.01	0.00	0.00	8.49	0.16	0.0487	0.0000	44.25	0.00	0.0311	0.0000	0.16	0.0000
CLAY	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
BEE	15.31		0.09		0.00		0.00		15.31	0.00	0.0880	0.0000	114.95	0.00	0.0950	0.0000	0.00	0.0000
MARTIN	18.85		0.07		0.00		0.00		18.85	0.00	0.0715	0.0000	169.97	0.00	0.0700	0.0000	0.00	0.0000
GONZALES	1.72		0.01		0.00		0.00		1.72	0.00	0.0101	0.0000	7.62	0.00	0.0078	0.0000	0.00	0.0000
BURLESON	21.55		0.12		0.00		0.00		21.55	0.00	0.1218	0.0000	124.65	0.00	0.1162	0.0000	0.00	0.0000
KARNES	43.01		0.25		0.00		0.00		43.01	0.00	0.2490	0.0000	178.81	0.00	0.1944	0.0000	0.00	0.0000
KLEBERG	39.18		0.20		0.00		0.00		39.18	0.00	0.1967	0.0000	172.46	0.00	0.2006	0.0000	0.00	0.0000
BREWSTER	37.39		0.17		0.00		0.00		37.39	0.00	0.1674	0.0000	246.01	0.00	0.1400	0.0000	0.00	0.0000
WINKLER	2.09		0.01		0.00		0.00		2.09	0.00	0.0079	0.0000	18.89	0.00	0.0078	0.0000	0.00	0.0000
FRANKLIN	4.27		0.03		0.00		0.00		4.27	0.00	0.0257	0.0000	24.49	0.00	0.0156	0.0000	0.00	0.0000
YOUNG	11.34	1.97	0.05	0.01	0.00	0.24	0.00	0.00	11.34	2.21	0.0493	0.0122	97.09	0.00	0.0389	0.0000	2.21	0.0122
HOUSTON	3.44		0.02		0.00		0.00		3.44	0.00	0.0195	0.0000	39.04	0.00	0.0211	0.0000	0.00	0.0000
SCURRY	97.00		0.32		249.98		0.75		346.97	0.00	1.0665	0.0000	3,568.36	0.02	0.5280	0.0000	0.02	0.0000
BOSQUE	4.25	0.06	0.02	0.00	29.43	0.01	0.15	0.00	33.67	0.07	0.1749	0.0006	120.12	0.00	0.0156	0.0000	0.07	0.0006
COMANCHE	2.12		0.01		0.00		0.00		2.12	0.00	0.0122	0.0000	11.06	0.00	0.0078	0.0000	0.00	0.0000
BRISCOE	22.52		0.03		0.00		0.00		22.52	0.00	0.0285	0.0000	423.62	0.00	0.0544	0.0000	0.00	0.0000
CONCHO	2.08		0.01		0.00		0.00		2.08	0.00	0.0093	0.0000	13.67	0.00	0.0078	0.0000	0.00	0.0000
ZAVALA	8.59		0.04		0.00		0.00		8.59	0.00	0.0429	0.0000	21.39	0.00	0.0311	0.0000	0.00	0.0000
NOLAN	2.27	0.18	0.01	0.00	0.00	0.02	0.00	0.00	2.27	0.20	0.0099	0.0013	19.42	0.00	0.0078	0.0000	0.20	0.0013
BROOKS	14.27		0.07		0.00		0.00		14.27	0.00	0.0694	0.0000	66.32	0.00	0.0613	0.0000	0.00	0.0000
ROBERTSON	11.76	0.26	0.07	0.00	0.00	0.03	0.00	0.00	11.76	0.29	0.0665	0.0009	67.99	0.00	0.0634	0.0000	0.29	0.0009
LIVE OAK	16.68		0.08		0.00		0.00		16.68	0.00	0.0837	0.0000	72.69	0.00	0.0845	0.0000	0.00	0.0000
HAMILTON	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
JONES	0.00	0.37	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.39	0.0000	0.0021	0.00	0.00	0.0000	0.0000	0.39	0.0021
REAGAN	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
WARD	14.66	5.87	0.06	0.04	0.00	0.71	0.00	0.01	14.66	6.58	0.0556	0.0439	132.20	0.00	0.0544	0.0000	6.58	0.0439
RED RIVER	23.01	0.00	0.14	0.00	0.00	0.00	0.00	0.00	23.01	0.00	0.1379	0.0000	291.09	0.00	0.1162	0.0000	0.00	0.0000
HASKELL	4.53	0.00	0.02	0.00	0.00	0.00	0.00	0.00	4.53	0.00	0.0197	0.0000	38.84	0.00	0.0156	0.0000	0.00	0.0000
HOWARD	4.19	0.18	0.02	0.00	0.00	0.02	0.00	0.00	4.19	0.20	0.0159	0.0013	37.77	0.00	0.0156	0.0000	0.20	0.0013
SAN SABA	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
JACK	9.07	0.67	0.04	0.00	0.00	0.08	0.00	0.00	9.07	0.75	0.0395	0.0048	77.67	0.00	0.0311	0.0000	0.75	0.0048
STEPHENS	6.80		0.03		0.00		0.00		6.80	0.00	0.0296	0.0000	58.26	0.00	0.0233	0.0000	0.00	0.0000
RUNNELS	2.08		0.01		0.00		0.00		2.08	0.00	0.0093	0.0000	13.67	0.00	0.0078	0.0000	0.00	0.0000
REEVES	2.09		0.01		0.00		0.00		2.09	0.00	0.0079	0.0000	18.89	0.00	0.0078	0.0000	0.00	0.0000
DE WITT	11.91		0.07		0.00		0.00		11.91	0.00	0.0685	0.0000	89.40	0.00	0.0739	0.0000	0.00	0.0000
CHILDRESS	5.82		0.02		0.00		0.00		5.82	0.00	0.0192	0.0000	102.64	0.00	0.0317	0.0000	0.00	0.0000
CROSBY	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
DAWSON	4.38		0.01		0.00		0.00		4.38	0.00	0.0137	0.0000	77.55	0.00	0.0204	0.0000	0.00	0.0000
MITCHELL	2.27	4.73	0.01	0.03	0.00	0.57	0.00	0.00	2.27	5.30	0.0099	0.0376	19.42	0.00	0.0078	0.0000	5.30	0.0376
WILBARGER	5.29	0.26	0.02	0.00	0.00	0.01	0.00	0.00	5.29	0.27	0.0232	0.0000	49.07	0.00	0.0156	0.0000	0.27	0.0000
COLEMAN	2.14	0.01	0.01	0.00	0.00	0.00	0.00	0.00	2.14	0.01	0.0099	0.0001	13.96	0.00	0.0078	0.0000	0.01	0.0001
UPTON	1.95	0.01	0.01	0.00	0.00	0.00	0.00	0.00	1.95	0.01	0.0082	0.0001	12.52	0.00	0.0078	0.0000	0.01	0.0001
COKE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
CROCKETT	39.47	0.00	0.18	0.00	0.00	0.00	0.00	0.00	39.47	0.00	0.1767	0.0000	259.68	0.00	0.1477	0.0000	0.00	0.0000
HARDEMAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
BANDERA	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
BAYLOR	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
COTTLE	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
CRANE	3.91		0.02		171.34		0.63		175.25	0.00	0.6419	0.0000	784.90	0.00	0.0156	0.0000	0.00	0.0000
DELTA	6.40		0.04		0.00		0.00		6.40	0.00	0.0386	0.0000	36.73	0.00	0.0233	0.0000	0.00	0.0000
DICKENS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
DUVAL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
EASTLAND	2.27		0.01		0.00		0.00		2.27	0.00	0.0099	0.0000	19.42	0.00	0.0078	0.0000	0.00	0.0000
EDWARDS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
FISHER	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
FOARD	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
GLASSCOCK	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
GOLIAD	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
HALL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
HUDSPETH	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
IRION	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
JEFF DAVIS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KENEDY	93.76		0.47		0.00		0.00		93.76	0.00	0.4695	0.0000	389.18	0.00	0.4330	0.0000	0.00	0.0000
KENT	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KING	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KINNEY	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
KNOX	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
LA SALLE	12.89		0.06		0.00		0.00		12.89	0.00	0.0643	0.0000	32.08	0.00	0.0467	0.0000	0.00	0.0000
LEON	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
LOVING	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
MENARD	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
MILLS	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
MONTAGUE	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
MOTLEY	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
REAL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
SCHLEICHER	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
SHACKELFORD	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
STARR	4.57		0.02		0.00		0.00		4.57	0.00	0.0229	0.0000	18.98	0.00	0.0211	0.0000	0.00	0.0000
STERLING	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
STONEWALL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
SUTTON	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
TERRELL	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
THROCKMORTON	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
ZAPATA	0.00		0.00		0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.00	0.0000	0.0000	0.00	0.0000
TOTAL	**#N/A**	**102.73**	**#N/A**	**0.59**	**143,654.46**	**11.39**	**706.76**	**0.07**	**#N/A**	**114.12**	**#N/A**	**0.67**	**1,139,529.75**	**5.24**	**598.76**	**0.00**	**119.36**	**0.67**



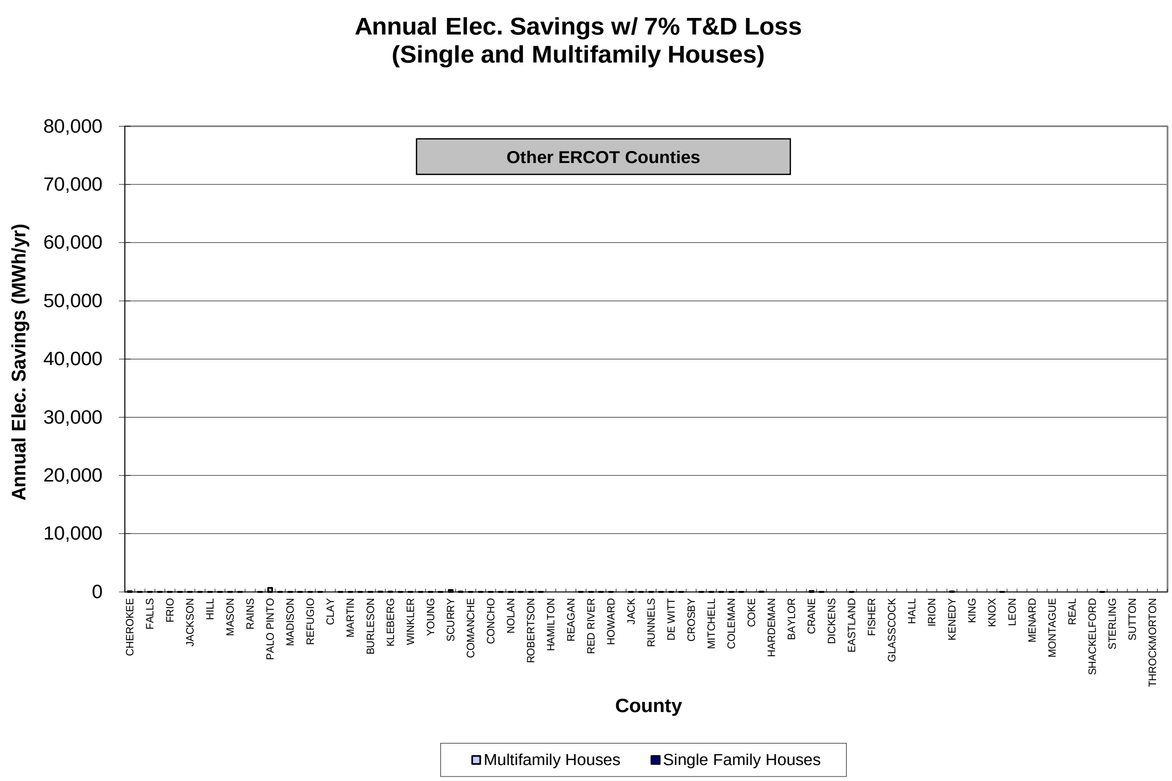
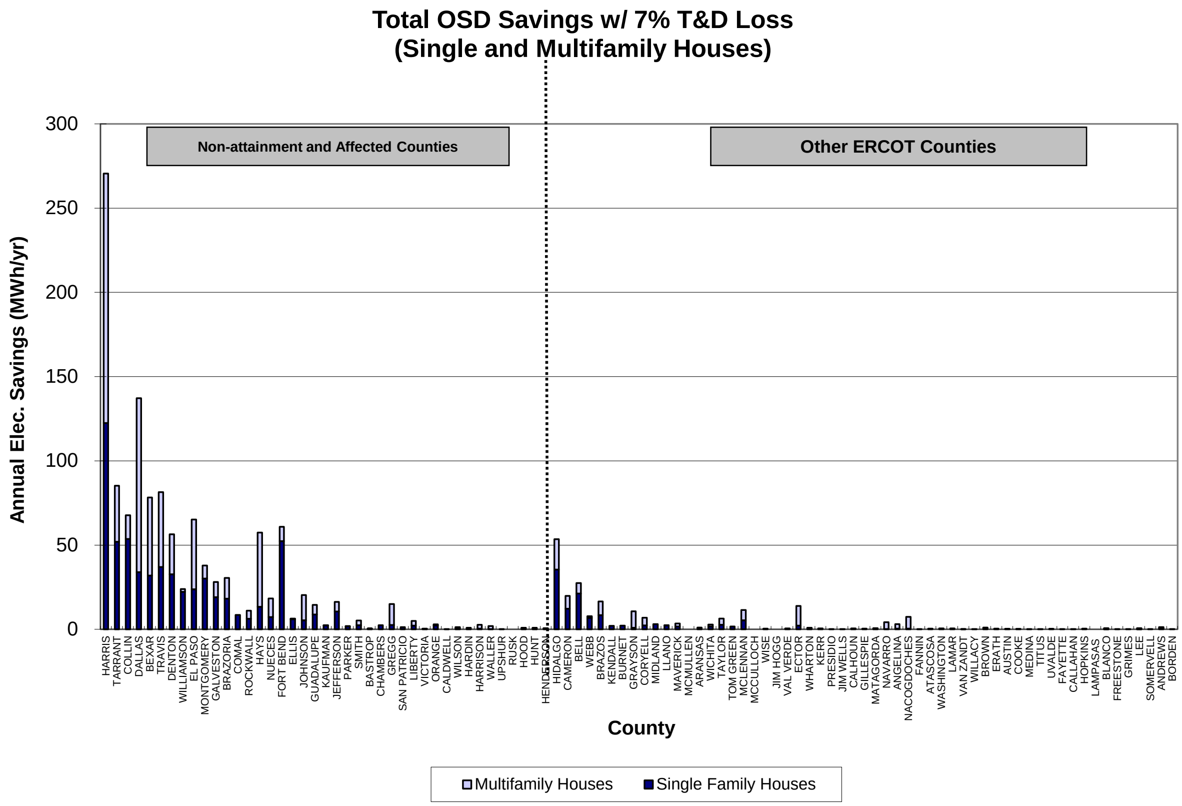


Figure 143: 2010 Annual Electricity Reductions from the 2000 IECC / IRC for Single-family and Multi-family Residences by County



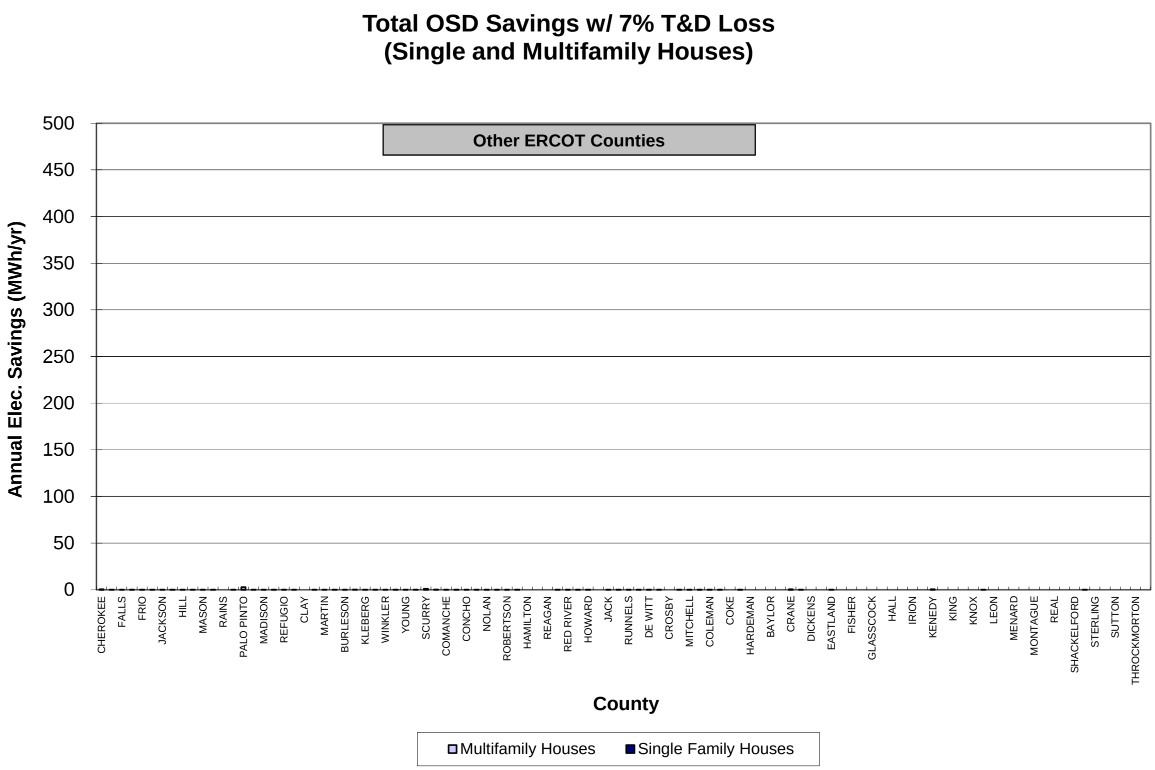


Figure 144: 2010 OSD Electricity Reductions from the 2000 IECC / IRC for Single-family and Multi-family Residences by County

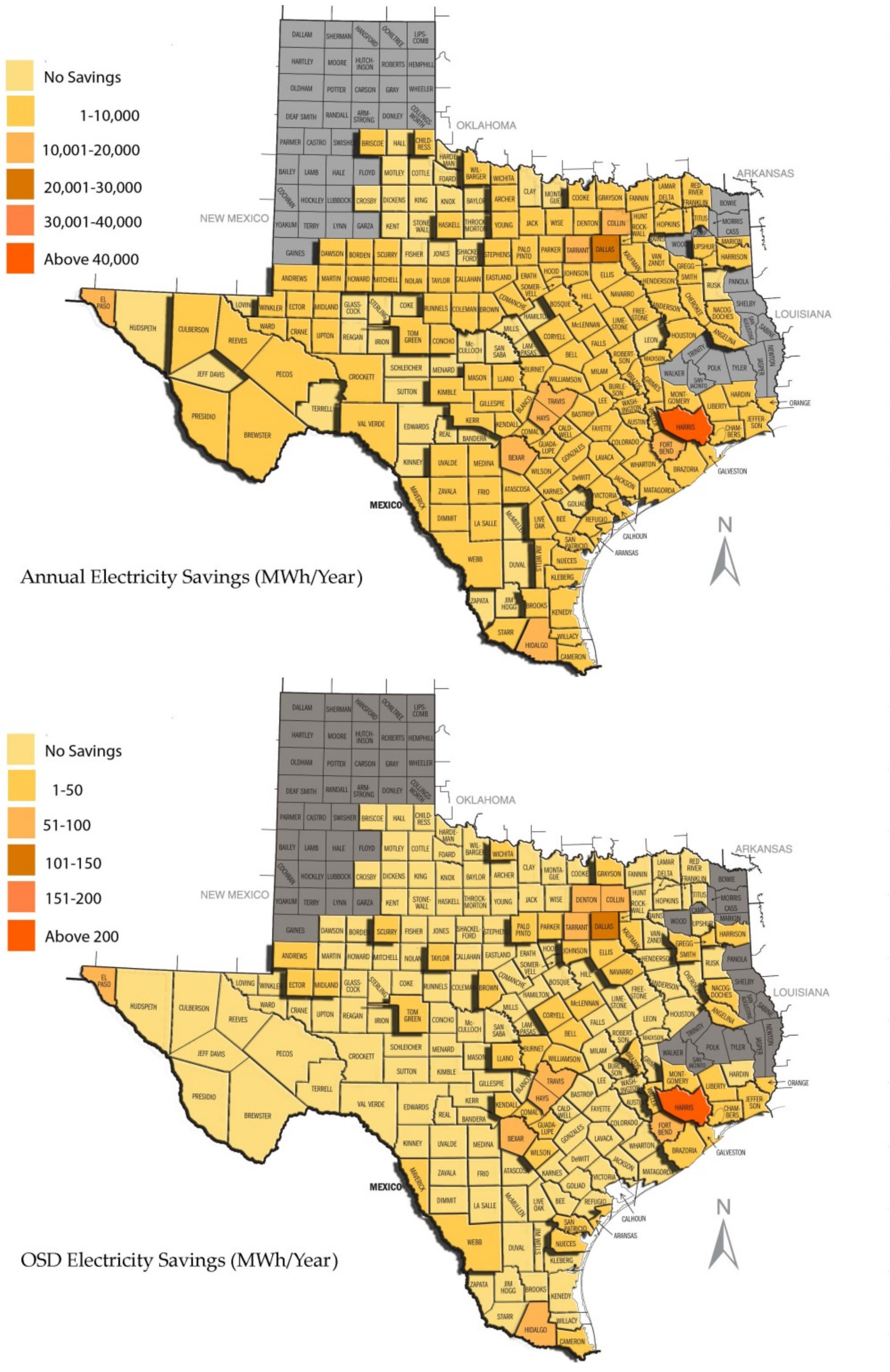
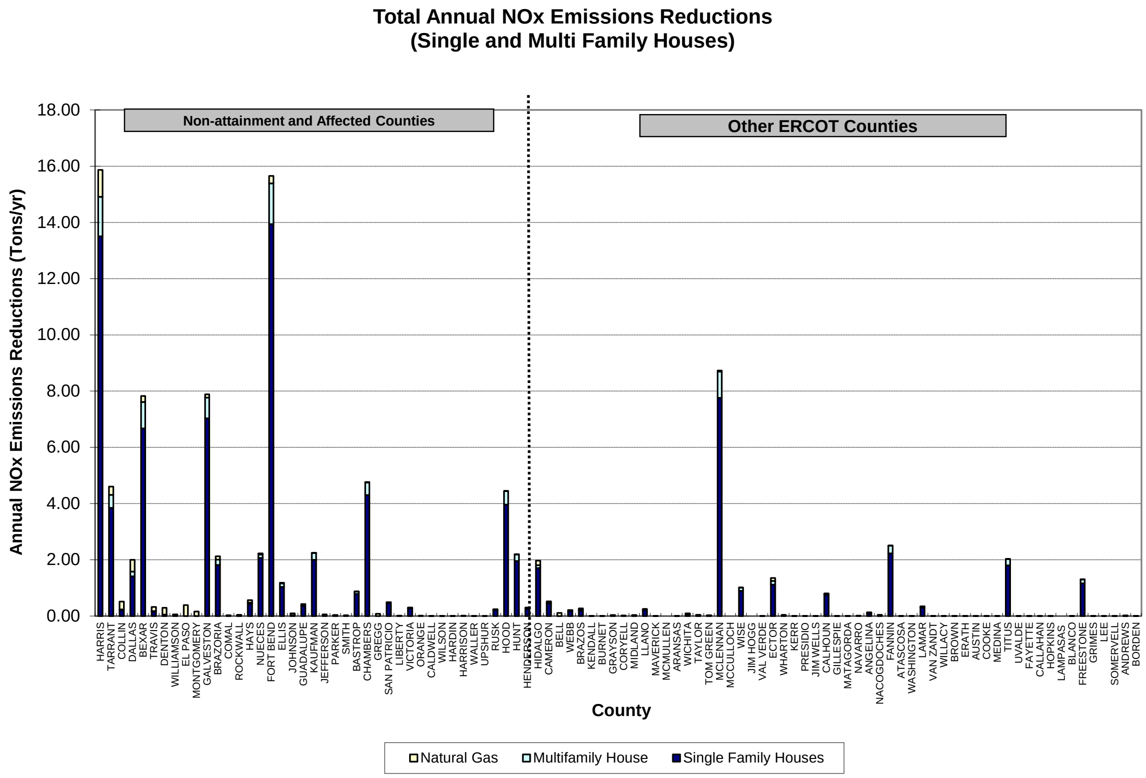


Figure 145: 2010 Annual and OSD Electricity Reductions from the 2000 IECC / IRC for Single-family and Multi-family Residences by County



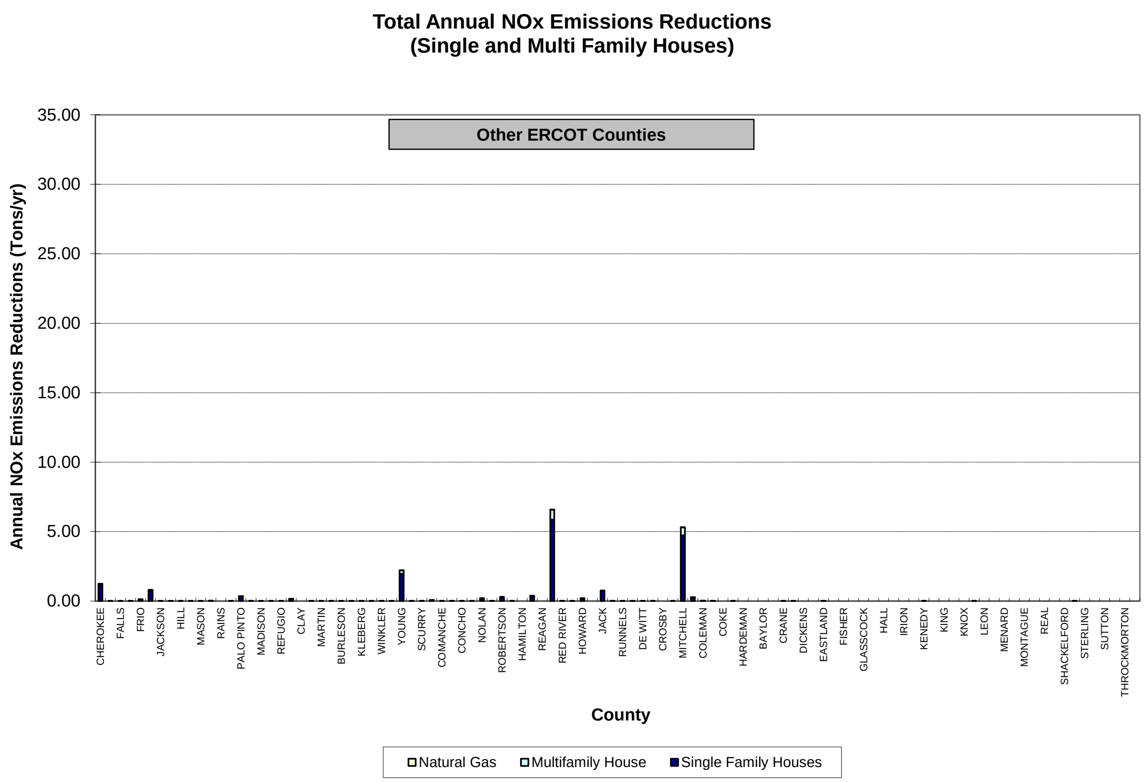
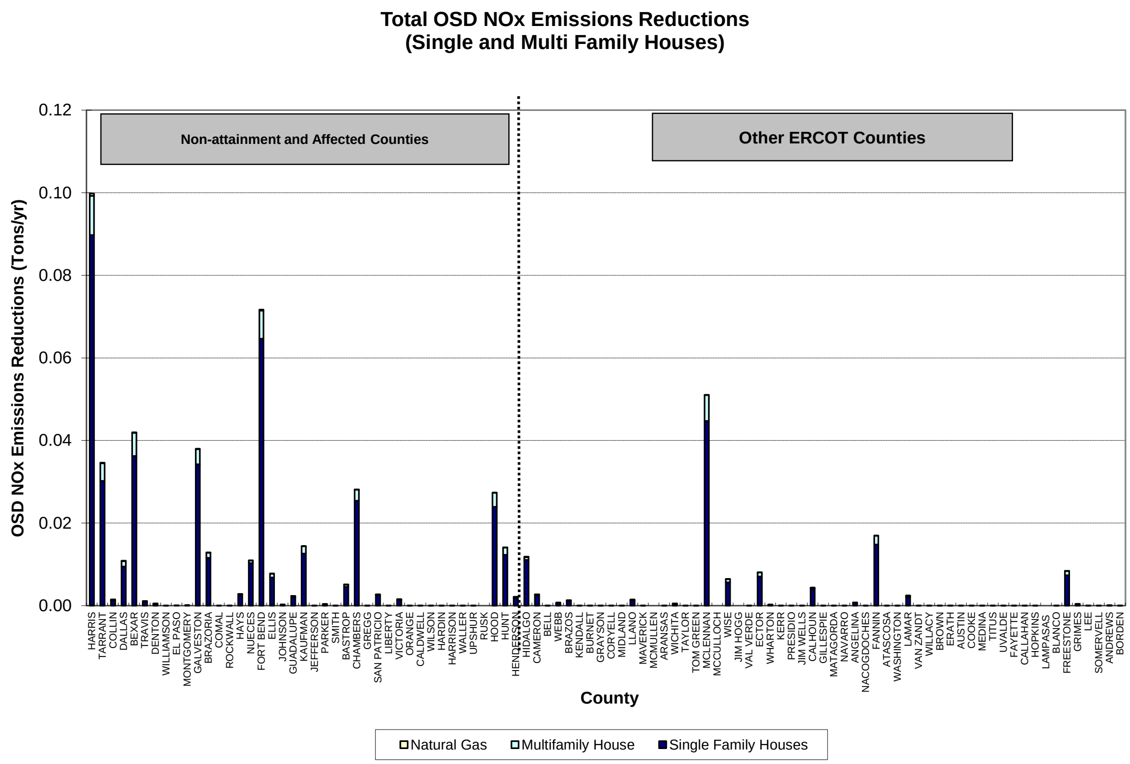


Figure 146: 2010 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences by County (using 1999 Base Year and 2007 eGRID)



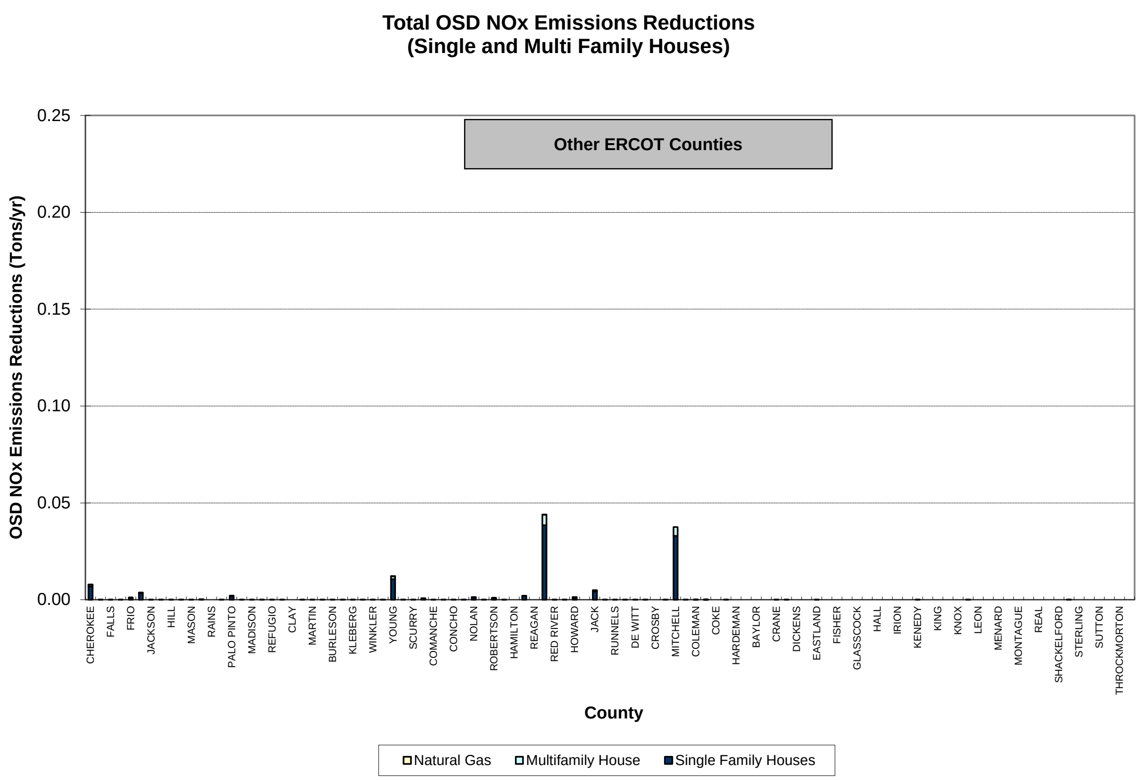
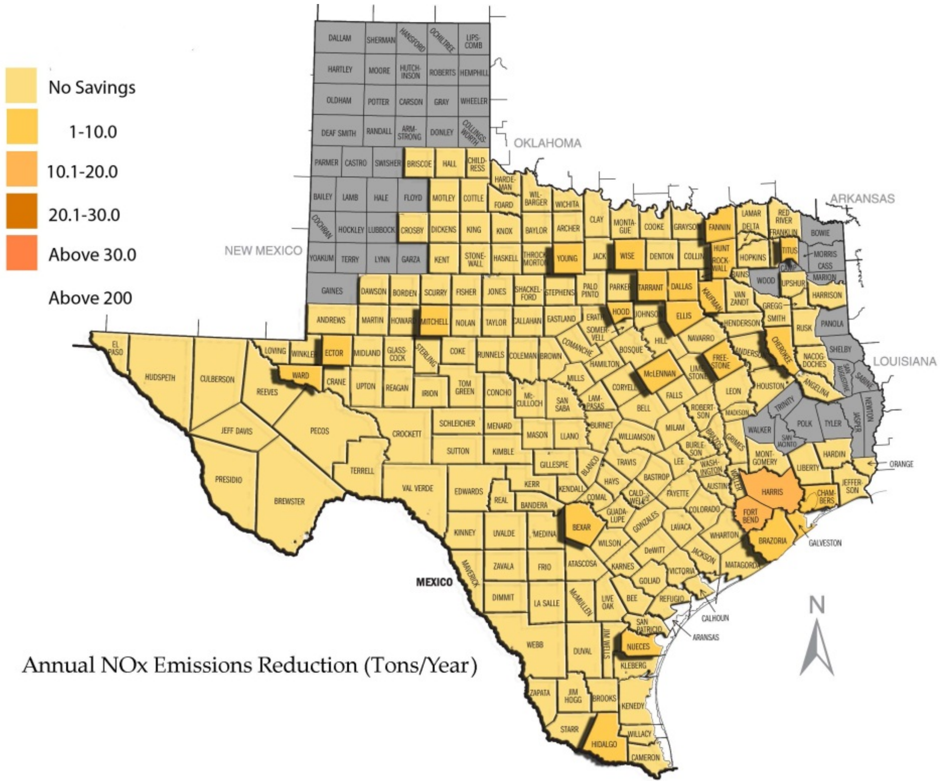


Figure 147: 2010 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences by County (using 1999 Base Year and 2007 eGRID)



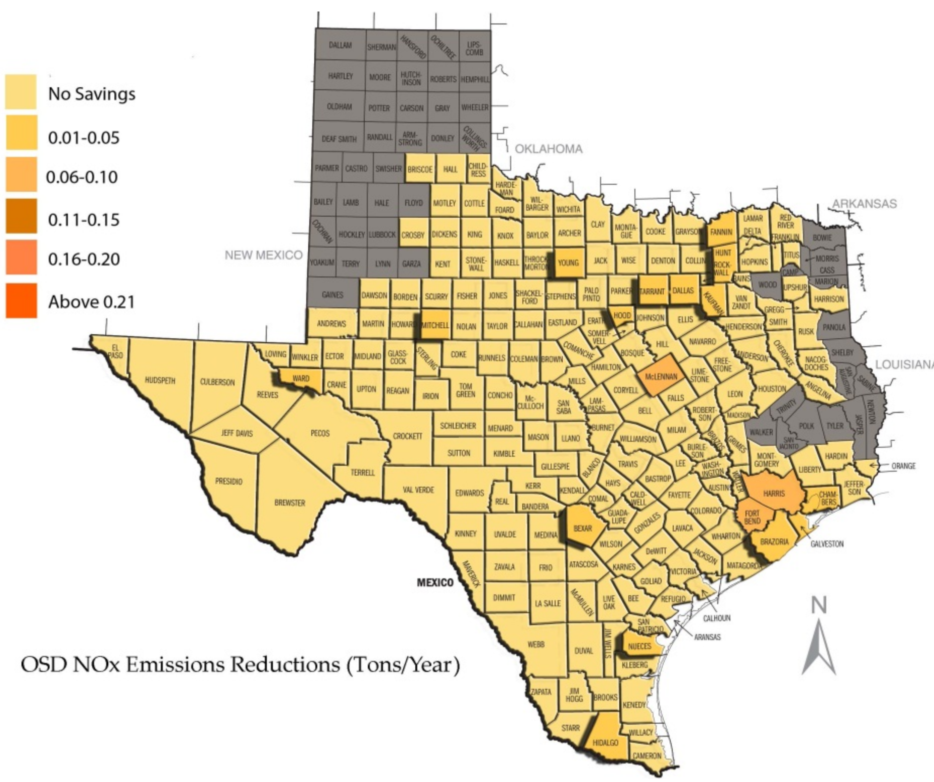


Figure 148: 2010 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences by County (Using 1999 Base year and 2007 eGRID)

6.1.4 2010 Results for Commercial Construction

This section reports on the calculated energy and emissions savings from new commercial construction in 2010 that was built to meet the new ASHRAE Standard 90.1-1999 energy code. Construction prior to September 2001 was assumed to comply with ASHRAE Standard 90.1-1989, which was determined from a survey of engineers and architects reported in the Laboratory's 2006 Annual report to the TCEQ. To determine the energy and emissions savings from new commercial construction in all counties in ERCOT region as well as the 41 non-attainment and affected counties, data from two sources were merged into one analysis as shown in Figure 150. In this figure, the analysis covers results shown in Figure 151 to Figure 154 and in Table 30 to Table 43.

Beginning in the upper left of Figure 150, the Dodge database of the square footage of new commercial construction in Texas (Dodge 2005) was merged with the energy savings calculations published by the Pacific Northwest National Laboratory (PNNL) in a report prepared for the U.S.D.O.E. (USDOE 2004). This allowed for the new construction to be tracked by county, and energy savings to be calculated by building type. In the next block in Figure 150 and Table 28, the merged categories from the Dodge and PNNL database can be seen. This resulted in 12 Dodge categories being merged into 7 PNNL energy use categories. In the third and fourth PNNL category, the Dodge "stores and restaurant" category had to be split into two categories to match the two PNNL categories for "retail" and "food". To accomplish this, information published in the 1999 and 2003 CBEC database (Table 29) by the U.S.D.O.E's Energy Information Agency (EIA) was used to determine the percentages used to split the Dodge conditioned area for each county as shown (i.e., 21.06% for food and 78.94% for retail). Table 30 and Table 31 show the Dodge data for 2005 prior to merging into the PNNL categories, which are shown by category in Figure 151 to Figure 154. Table 32 to Table 34 shows the Dodge data for 2005 after merging into the required PNNL categories for the energy savings calculations, which were then used with the Dodge data from Table 30 and Table 31 for 2005 in the 2010 calculations. The square footage of all PNNL building types are shown for each county, followed by individual graphs of each building type in the lower seven graphs.

In the next step the PNNL energy savings, which represent buildings built to ASHRAE Standard 90.1-1989 versus Standard 90.1-1999, which are expressed per square foot, were then multiplied by the published square feet of new construction. For the 2010 results, the values for 2005 were assumed[32] for 2010. Table 35 to Table 43 show the annual and OSD energy use calculated for new construction, by building type, for Standard 90.1-1989, and 90.1-1999. Table 44 to Table 51 shows the county-wide annual electricity and natural gas savings by building type[33] [34].

In order to calculate the Ozone Season Day electricity and natural gas savings, simulations were performed on a typical office building that simulated a 6-story, 90,000-sq. ft. office building in Central Texas. Figure 155 provides an image of the office building (3-story shown). Table 37 (building LOADS) and Table 383 (building SYSTEM and PLANT information) provide the input characteristics used to simulate the office building. The results of these simulations show about a 13% annual energy use reduction (Haberl et al. 2005). The simulations were also used to simulate the electricity and natural gas used during the Ozone Season Day (July 15 to Sept. 15) as shown in Figure 157, Figure 158 , and Table 52. In the bottom row of Table 39, a ratio was calculated to allow for the conversion of annual savings to OSD savings. This ratio was then used in the remaining building types to accomplish this conversion.

In the next calculation step, electric utility providers were assigned to each county according to the published sales data from the Texas Public Utilities Commission as shown in Table 40. In the case where more than one utility was shown selling electricity in a county, a percentage of electricity use was allocated according to the PUCT's sales data. In the lower half of Table 53, the total electricity savings by utility provider is shown for 2010 for all estimated new commercial construction. Table 416 shows the calculated annual NOx emissions reductions from electricity using the 2007 eGRID table for Texas.

In a similar fashion as the annual calculations, electric utility providers were assigned to each county to calculate the OSD electricity savings by utility, as shown in Table 57. Table 58 shows the calculated NOx emissions reductions from electricity savings using the 2007 eGRID table for Texas.

[32] This assumption is based on conversations with Texas State demographer's office.
[33] In this table (-) values are savings, (+) values are increased energy use.
[34] In a similar fashion as the proceeding table, in this table (-) values are savings, (+) values are increased energy use.

Table 59 and Table 60 show the transformation of the annual and OSD county-wide electricity and natural gas savings, along with the associated 2010 NOx emissions reductions with 7% T&D losses. Figure 159 and Figure 160 show the bar chart of the annual and OSD electricity savings for 2010, respectively. Figure 161 and Figure 162 present the NOx emissions reductions from the electricity use savings using the 2007 eGRID for Texas.

6.1.5 2010 Results for New Residential (Single-family and Multi-family), and Commercial Construction using 2007 eGRID

Using the 2007 eGRID, the total NOx reductions from electricity and natural gas savings from new commercial construction in 2010 are calculated to be 38.51 tons NOx/year which represents 41.35 tons NOx/year from electricity savings and an increase of 2.84 tons NOx/year from natural gas. On a peak Ozone Season Day (OSD), the NOx reductions in 2010 are calculated to be 0.31 tons of NOx/day which represents 0.26 tons NOx/day from electricity savings and 0.05 tons NOx/day from natural gas savings.

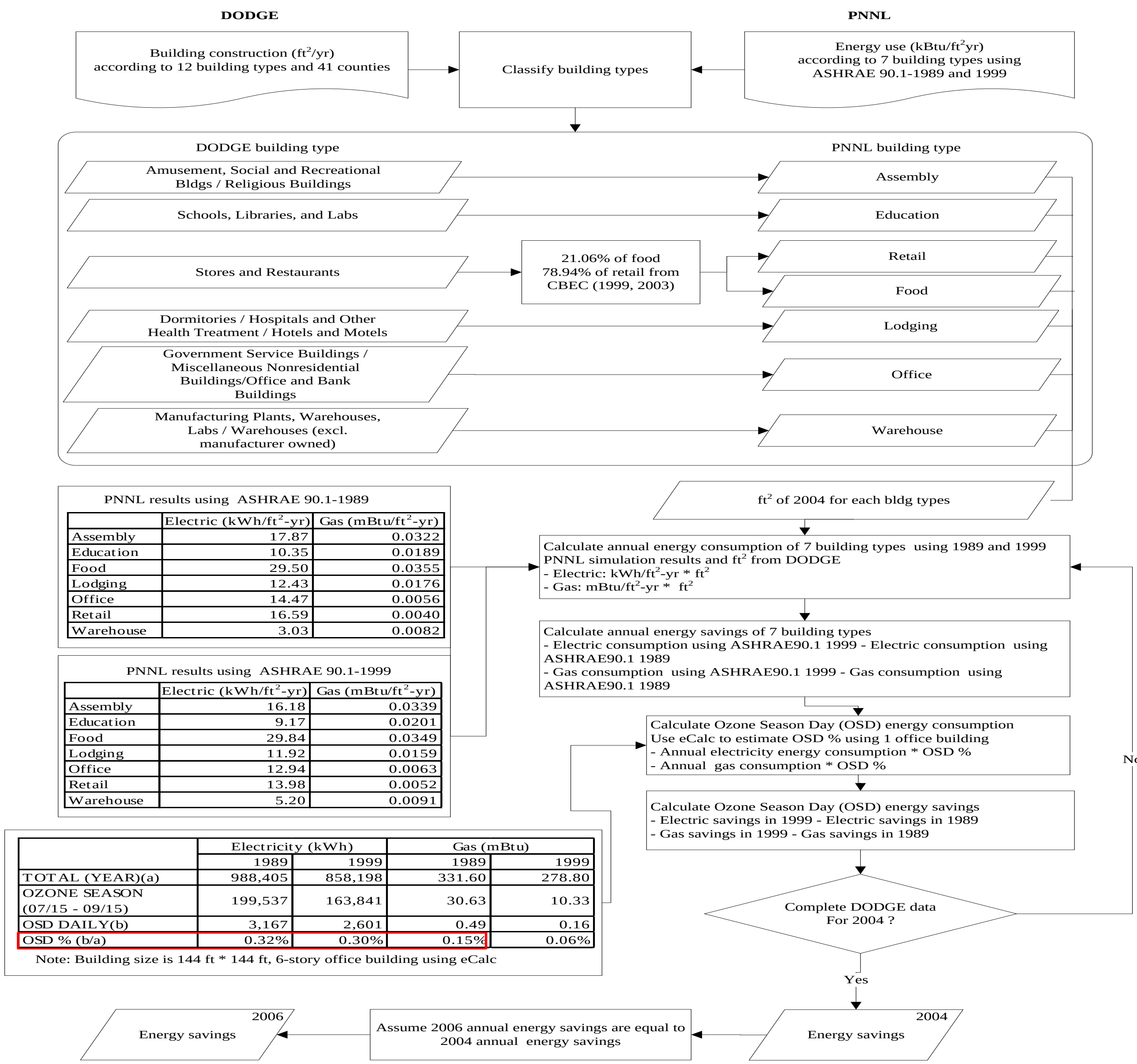


Figure 149: Analysis Method for Calculating the 2010 Energy and Emissions Savings from Commercial Buildings

Table 28: Commercial Building Descriptions from USDOE (2004) Report and Dodge (2005)

No	PNNL Bldg Types	Dodge Bldg Types
1	Assembly	Amusement, Social and Recreational Bldgs
2		Religious Buildings
3	Education	Schools, Libraries, and Labs (nonmfg)
4	Retail	Stores and Restaurants
5	Food	Stores and Restaurants
6	Lodging	Dormitories
7		Hospitals and Other Health Treatment
8		Hotels and Motels
9	Office	Government Service Buildings
10		Miscellaneous Nonresidential Buildings
11		Office and Bank Buildings
12	Warehouse	Manufacturing Plants, Warehouses, Labs
13		Warehouses (excl. manufacturer owned)

Table 29: Floor Area from CBEC (1999, 2003) database for Retail and Food Type Commercial Buildings

		CBEC (1999)		CBEC (2003)	
		All (million square feet)	South (million square feet)	All (million square feet)	South (million square feet)
Food	Food Sales	994	392	1,255	487
	Food Service	1851	676	1,654	764
Retail	Retail (Other Than Mall)	4766	1566	4,317	1,844
	Enclosed and Strip Malls	5631	2513	6,875	3,251

	South		All	
	Food %	Retail %	Food %	Retail %
CBEC (1999)	20.75	79.25	21.48	78.52
CBEC (2003)	19.71	80.29	20.63	79.37
Average	20.23	79.77	21.06	78.94

Table 30: 2010 New Commercial Building Constructions (sq. ft. x 1000) [35]

Table shows Dodge (2005) data before merging into PNNL building types (sq. ft. x 1000) (Part 1)

County	Assembly	Education	Retail	Food	Lodging	Office	Warehouse
HARRIS	1424	2949	2360	630	1642	2392	4792
TARRANT	737	1564	1667	445	1003	902	1875
COLLIN	459	974	1131	302	487	683	490
DALLAS	909	1769	1283	342	865	2020	2910
BEXAR	532	1781	1141	305	1202	886	904
TRAVIS	315	525	646	172	652	527	398
DENTON	327	1041	621	166	383	315	758
WILLIAMSON	116	399	305	81	123	134	119
EL PASO	295	746	343	92	300	461	1116
MONTGOMERY	176	477	408	109	195	321	204
GALVESTON	84	197	173	46	106	174	62
BRAZORIA	94	366	237	63	57	70	115
COMAL	25	145	71	19	47	52	28
ROCKWALL	26	158	95	25	15	26	36
HAYS	75	219	121	32	59	137	65
NUECES	102	150	70	19	162	121	124
FORT BEND	211	546	454	121	182	347	484
ELLIS	46	117	63	17	21	26	300
JOHNSON	9	134	51	14	4	8	64
GUADALUPE	21	140	69	18	38	66	142
KAUFMAN	20	118	28	8	5	15	79
JEFFERSON	88	117	165	44	245	102	48
PARKER	10	130	71	19	37	8	6
SMITH	80	113	87	23	120	121	147
BASTROP	5	53	16	4	45	6	6
CHAMBERS	7	33	5	1	0	13	0
GREGG	48	33	45	12	80	25	42
SAN PATRICIO	13	56	23	6	19	75	241
LIBERTY	5	171	13	3	6	15	2
VICTORIA	17	16	29	8	20	17	10
ORANGE	11	107	17	5	19	18	15
CALDWELL	2	60	12	3	6	2	11
WILSON	2	24	5	1	10	0	0
HARDIN	6	38	13	3	0	1	0
HARRISON	39	61	32	9	33	13	10
WALLER	3	12	0	0	0	0	14
UPSHUR	11	29	4	1	2	5	2
RUSK	1	6	11	3	1	2	2
HOOD	34	62	12	3	6	10	0
HUNT	17	80	14	4	13	18	11
HENDERSON	4	21	9	2	2	3	17
HIDALGO	0	0	0	0	0	0	0
CAMERON	80	390	169	45	215	170	298
BELL	78	257	88	23	326	162	118
WEBB	28	275	53	14	95	78	118
BRAZOS	150	293	106	28	209	188	54
KENDALL	0	0	0	0	0	0	0
BURNET	7	51	10	3	9	12	2
GRAYSON	25	113	43	12	35	17	90
CORYELL	13	35	19	5	16	4	7
MIDLAND	88	59	89	24	51	59	18
LLANO	1	24	0	0	56	4	0
MAVERICK	13	41	12	3	28	24	1
MCMULLEN	2	1	0	0	0	1	0
ARANSAS	4	1	26	7	7	14	0
WICHITA	59	50	51	13	165	57	28
TAYLOR	34	49	80	21	60	32	52
TOM GREEN	61	89	52	14	112	40	33
MCLENNAN	71	266	99	26	122	92	121
MCCULLOCH	0	9	0	0	0	0	0
WISE	18	73	1	0	47	19	0
JIM HOGG	0	8	0	0	1	10	0
VAL VERDE	9	29	7	2	9	27	3
ECTOR	28	92	38	10	125	22	219
WHARTON	9	16	30	8	6	6	11
KERR	43	50	23	6	53	26	0
PRESIDIO	3	5	0	0	0	1	0
JIM WELLS	0	47	22	6	23	7	4
CALHOUN	0	11	18	5	1	21	0
GILLESPIE	8	6	13	3	7	2	5
MATAGORDA	4	26	5	1	9	6	7
NAVARRO	3	30	18	5	14	2	34
ANGELINA	33	53	45	12	29	21	7
NACOGDOCHES	22	117	19	5	27	14	13
FANNIN	6	20	3	1	4	2	5
ATASCOSA	11	21	11	3	9	2	2
WASHINGTON	30	36	33	9	12	13	25
LAMAR	4	29	5	1	2	5	2
VAN ZANDT	1	41	0	0	0	1	0
WILLACY	2	42	27	7	1	26	7
BROWN	5	15	8	2	12	10	6
ERATH	4	31	2	1	8	2	2
AUSTIN	1	38	1	0	5	1	194
COOKE	21	76	50	13	66	16	19
MEDINA	3	20	1	0	0	11	1
TITUS	4	26	7	2	0	2	0
UVALDE	14	32	33	9	5	7	8
FAYETTE	2	14	3	1	15	4	1
CALLAHAN	3	18	0	0	0	3	1
HOPKINS	5	17	10	3	5	2	12
LAMPASAS	2	9	12	3	7	4	0
BLANCO	0	18	0	0	0	0	0
FREESTONE	0	8	0	0	1	1	0
GRIMES	3	8	0	0	0	4	0
LEE	1	13	1	0	0	5	0
SOMERVELL	0	7	0	0	1	5	1
ANDREWS	1	6	0	0	3	0	0
BORDEN	0	0	0	0	0	0	0
CHEROKEE	37	56	10	3	26	21	34
DIMMIT	0	3	0	0	0	6	0

[35] Source: Dodge/McGraw-Hill 2007

Table 31: 2010 New Commercial Building Constructions (sq. ft. x 1000) [36]

Table shows Dodge (2005) data before merging into PNNL building types (sq. ft. x 1000) (Part 2)

County	Assembly	Education	Retail	Food	Lodging	Office	Warehouse
FALLS	0	0	0	0	0	0	0
COLORADO	0	17	0	0	4	8	0
FRIO	0	16	4	1	2	1	0
MILAM	3	39	10	3	0	19	0
JACKSON	1	16	1	0	0	0	0
ANDERSON	1	1	2	1	2	2	1
HILL	4	49	7	2	3	1	0
CULBERSON	1	8	0	0	0	1	0
MASON	0	1	0	0	0	2	0
PECOS	3	6	0	0	9	11	0
RAINS	1	8	0	0	0	1	0
LAVACA	7	2	0	0	1	2	0
PALO PINTO	4	26	15	4	3	2	2
KIMBLE	2	0	0	0	0	2	0
MADISON	1	10	0	0	0	0	0
ARCHER	1	17	0	0	4	0	2
REFUGIO	1	1	0	0	0	2	0
LIMESTONE	3	5	9	2	4	9	0
CLAY	0	3	0	0	0	5	0
BEE	19	49	5	1	21	19	0
MARTIN	0	0	0	0	0	0	0
GONZALES	0	4	1	0	2	1	0
BURLESON	1	12	1	0	2	8	0
KARNES	0	7	0	0	1	5	0
KLEBERG	6	38	33	9	8	6	1
BREWSTER	4	11	0	0	6	10	6
WINKLER	1	0	0	0	0	0	0
FRANKLIN	0	0	0	0	0	0	26
YOUNG	10	21	23	6	6	4	2
HOUSTON	2	5	17	5	7	2	0
SCURRY	1	0	4	1	2	1	12
BOSQUE	1	16	0	0	0	1	0
COMANCHE	7	36	1	0	72	0	2
BRISCOE	0	0	0	0	0	0	0
CONCHO	0	0	0	0	0	2	0
ZAVALA	0	5	0	0	1	1	0
NOLAN	6	17	10	3	8	0	0
BROOKS	0	0	0	0	0	9	0
ROBERTSON	1	3	0	0	1	0	1
LIVE OAK	10	0	0	0	0	0	0
HAMILTON	0	6	0	0	4	0	0
JONES	8	8	0	0	0	0	4
REAGAN	1	0	0	0	0	8	0
WARD	0	0	0	0	0	7	0
RED RIVER	2	14	0	0	0	0	0
HASKELL	0	0	9	2	0	14	0
HOWARD	4	10	1	0	5	3	0
SAN SABA	4	3	1	0	0	0	0
JACK	1	1	0	0	0	17	0
STEPHENS	0	6	0	0	1	0	0
RUNNELS	0	6	1	0	0	2	0
REEVES	5	2	0	0	4	47	0
DE WITT	0	0	0	0	0	0	0
CHILDRESS	0	0	0	0	0	0	0
CROSBY	1	0	0	0	1	0	0
DAWSON	0	7	0	0	0	16	0
MITCHELL	4	0	0	0	5	14	0
WILBARGER	3	7	9	2	11	17	1
COLEMAN	1	1	0	0	1	1	0
UPTON	0	0	0	0	0	0	0
COKE	0	0	0	0	0	0	0
CROCKETT	3	2	0	0	0	0	0
HARDEMAN	0	0	0	0	0	0	0
BANDERA	0	0	0	0	0	0	0
BAYLOR	0	1	0	0	2	0	0
COTTLE	0	2	0	0	0	0	0
CRANE	1	1	0	0	0	0	0
DELTA	0	3	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0
DUVAL	0	20	1	0	0	4	0
EASTLAND	7	4	20	5	1	4	0
EDWARDS	0	0	0	0	0	0	0
FISHER	0	3	0	0	2	0	0
FOARD	0	0	0	0	0	0	0
GLASSCOCK	0	0	0	0	0	0	0
GOLIAD	0	4	0	0	0	1	0
HALL	0	1	0	0	0	0	0
HUDSPETH	1	9	0	0	0	13	0
IRION	0	0	0	0	0	0	0
JEFF DAVIS	6	0	0	0	0	2	0
KENEDY	0	0	0	0	0	1	0
KENT	0	0	0	0	2	0	0
KING	0	0	0	0	0	0	0
KINNEY	0	3	0	0	0	23	0
KNOX	1	1	0	0	0	0	0
LA SALLE	0	1	0	0	2	0	0
LEON	7	7	0	0	0	0	0
LOVING	0	0	0	0	0	0	0
MENARD	0	1	0	0	0	0	0
MILLS	2	8	0	0	0	1	0
MONTAGUE	1	13	10	3	6	5	1
MOTLEY	0	1	0	0	0	0	0
REAL	0	1	0	0	4	1	0
SCHLEICHER	0	0	0	0	0	0	0
SHACKELFORD	2	4	0	0	2	0	0
STARR	0	0	0	0	0	0	0
STERLING	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0
SUTTON	0	2	0	0	1	1	0
TERRELL	0	0	0	0	0	6	0
THROCKMORTON	1	0	0	0	0	1	0
ZAPATA	2	40	1	0	1	12	0
TOTAL	7632	19555	13469	3593	10475	11788	17272

[36] Source: Dodge/McGraw-Hill 2007

Table 32: 2010 New Commercial Building Constructions (sq. ft. x 1000) [37]

Table shows Dodge (2005) data merged into PNNL building types (sq. ft. x 1000) (Part 1)

(square feet in thousands)								
Non-attainment Counties	**Assembly**	**Education**	**Retail**	**Food**	**Lodging**	**Office**	**Warehouse**	**Stores and Restaurants**
BRAZORIA	94	366	237	63	57	70	115	514
CHAMBERS	7	33	5	1	0	13	0	0
COLLIN	459	974	1,131	302	487	683	490	1,580
DALLAS	909	1,769	1,283	342	865	2,020	2,910	2,004
DENTON	327	1,041	621	166	383	315	758	907
EL PASO	295	746	343	92	300	461	1,116	537
FORT BEND	211	546	454	121	182	347	484	370
GALVESTON	84	197	173	46	106	174	62	426
HARDIN	6	38	13	3	0	1	0	0
HARRIS	1,424	2,949	2,360	630	1,642	2,392	4,792	4,778
JEFFERSON	88	117	165	44	245	102	48	195
LIBERTY	5	171	13	3	6	15	2	9
MONTGOMERY	176	477	408	109	195	321	204	452
ORANGE	11	107	17	5	19	18	15	104
TARRANT	737	1,564	1,667	445	1,003	902	1,875	2,836
WALLER	3	12	0	0	0	0	14	22
TOTAL (NON-ATTAINMENT)	4,836	11,106	8,892	2,372	5,490	7,833	12,884	14,734

Affected Counties	**Assembly**	**Education**	**Retail**	**Food**	**Lodging**	**Office**	**Warehouse**	**Stores and Restaurants**
BASTROP	5	53	16	4	45	6	6	29
BEXAR	532	1,781	1,141	305	1,202	886	904	1,735
CALDWELL	2	60	12	3	6	2	11	4
COMAL	25	145	71	19	47	52	28	152
ELLIS	46	117	63	17	21	26	300	87
GREGG	48	33	45	12	80	25	42	13
GUADALUPE	21	140	69	18	38	66	142	387
HARRISON	39	61	32	9	33	13	10	4
HAYS	75	219	121	32	59	137	65	405
HENDERSON	4	21	9	2	2	3	17	2
HOOD	34	62	12	3	6	10	0	0
HUNT	17	80	14	4	13	18	11	15
JOHNSON	9	134	51	14	4	8	64	193
KAUFMAN	20	118	28	8	5	15	79	194
NUECES	102	150	70	19	162	121	124	103
PARKER	10	130	71	19	37	8	6	532
ROCKWALL	26	158	95	25	15	26	36	152
RUSK	1	6	11	3	1	2	2	140
SAN PATRICIO	13	56	23	6	19	75	241	161
SMITH	80	113	87	23	120	121	147	64
TRAVIS	315	525	646	172	652	527	398	1,436
UPSHUR	11	29	4	1	2	5	2	0
VICTORIA	17	16	29	8	20	17	10	15
WILLIAMSON	116	399	305	81	123	134	119	946
WILSON	2	24	5	1	10	0	0	74
TOTAL (AFFECTED)	1,570	4,630	3,030	808	2,723	2,302	2,763	6,843

[37] Source: Dodge/McGraw-Hill 2007

Table 33: 2010 New Commercial Building Constructions (sq. ft. x 1000) [38]

Table shows Dodge (2005) data merged into PNNL building types (sq. ft. x 1000) (Part 2)

ERCOT Counties	Assembly	Education	Retail	Food	Lodging	Office	Warehouse	Stores and Restaurants
ANDERSON	1	1	2	1	2	2	1	28
ANDREWS	1	6	0	0	3	0	0	0
ANGELINA	33	53	45	12	29	21	7	134
ARANSAS	4	1	26	7	7	14	0	160
ARCHER	1	17	0	0	4	0	2	0
ATASCOSA	11	21	11	3	9	2	2	3
AUSTIN	1	38	1	0	5	1	194	0
BANDERA	0	0	0	0	0	0	0	0
BASTROP	0	0	0	0	0	0	0	29
BAYLOR	0	1	0	0	2	0	0	0
BEE	19	49	5	1	21	19	0	0
BELL	78	257	88	23	326	162	118	510
BEXAR	532	1,781	1,141	305	1,202	886	904	1,735
BLANCO	0	18	0	0	0	0	0	0
BORDEN	0	0	0	0	0	0	0	0
BOSQUE	1	16	0	0	0	1	0	0
BRAZORIA	94	366	237	63	57	70	115	514
BRAZOS	150	293	106	28	209	188	54	158
BREWSTER	4	11	0	0	6	10	6	0
BRISCOE	0	0	0	0	0	0	0	0
BROOKS	0	0	0	0	0	9	0	0
BROWN	5	15	8	2	12	10	6	105
BURLESON	1	12	1	0	2	8	0	0
BURNET	7	51	10	3	9	12	2	28
CALDWELL	0	0	0	0	0	0	0	4
CALHOUN	0	11	18	5	1	21	0	155
CALLAHAN	3	18	0	0	0	3	1	0
CAMERON	80	390	169	45	215	170	298	512
CHAMBERS	7	33	5	1	0	13	0	0
CHEROKEE	37	56	10	3	26	21	34	6
CHILDRESS	0	0	0	0	0	0	0	0
CLAY	0	3	0	0	0	5	0	0
COKE	0	0	0	0	0	0	0	0
COLEMAN	1	1	0	0	1	1	0	0
COLLIN	459	974	1,131	302	487	683	490	1,580
COLORADO	0	17	0	0	4	8	0	0
COMAL	25	145	71	19	47	52	28	152
COMANCHE	7	36	1	0	72	0	2	0
CONCHO	0	0	0	0	0	2	0	0
COOKE	21	76	50	13	66	16	19	0
CORYELL	13	35	19	5	16	4	7	155
COTTLE	0	2	0	0	0	0	0	0
CRANE	1	1	0	0	0	0	0	0
CROCKETT	3	2	0	0	0	0	0	0
CROSBY	1	0	0	0	1	0	0	0
CULBERSON	1	8	0	0	0	1	0	0
DALLAS	0	0	0	0	0	0	0	2,004
DAWSON	0	7	0	0	0	16	0	0
DE WITT	0	0	0	0	0	0	0	0
DELTA	0	3	0	0	0	0	0	0
DENTON	0	0	0	0	0	0	0	907
DICKENS	0	0	0	0	0	0	0	0
DIMMIT	0	3	0	0	0	6	0	0
DUVAL	0	20	1	0	0	4	0	0
EASTLAND	7	4	20	5	1	4	0	0
ECTOR	28	92	38	10	125	22	219	26
EDWARDS	0	0	0	0	0	0	0	0
ELLIS	46	117	63	17	21	26	300	87
ERATH	4	31	2	1	8	2	2	15
FALLS	0	0	0	0	0	0	0	0
FANNIN	6	20	3	1	4	2	5	0
FAYETTE	2	14	3	1	15	4	1	0
FISHER	0	3	0	0	2	0	0	0
FOARD	0	0	0	0	0	0	0	0
FORT BEND	0	0	0	0	0	0	0	370
FRANKLIN	0	0	0	0	0	0	26	0
FREESTONE	0	8	0	0	1	1	0	0
FRIO	0	16	4	1	2	1	0	0
GALVESTON	0	0	0	0	0	0	0	426
GILLESPIE	8	6	13	3	7	2	5	155
GLASSCOCK	0	0	0	0	0	0	0	0
GOLIAD	0	4	0	0	0	1	0	0
GONZALES	0	4	1	0	2	1	0	7
GRAYSON	25	113	43	12	35	17	90	103
GRIMES	3	8	0	0	0	4	0	0
GUADALUPE	21	140	69	18	38	66	142	387
HALL	0	1	0	0	0	0	0	0
HAMILTON	0	6	0	0	4	0	0	0
HARDEMAN	0	0	0	0	0	0	0	0
HARRIS	1,424	2,949	2,360	630	1,642	2,392	4,792	4,778
HASKELL	0	0	9	2	0	14	0	0
HAYS	75	219	121	32	59	137	65	405
HENDERSON	0	0	0	0	0	0	0	2
HIDALGO	0	0	0	0	0	0	0	943
HILL	4	49	7	2	3	1	0	0
HOOD	34	62	12	3	6	10	0	0
HOPKINS	5	17	10	3	5	2	12	3
HOUSTON	2	5	17	5	7	2	0	0
HOWARD	4	10	1	0	5	3	0	6
HUDSPETH	1	9	0	0	0	13	0	0
HUNT	17	80	14	4	13	18	11	15
IRION	0	0	0	0	0	0	0	0
JACK	1	1	0	0	0	17	0	0
JACKSON	1	16	1	0	0	0	0	0
JEFF DAVIS	6	0	0	0	0	2	0	0
JIM HOGG	0	8	0	0	1	10	0	0
JIM WELLS	0	47	22	6	23	7	4	3
JOHNSON	9	134	51	14	4	8	64	193
JONES	8	8	0	0	0	0	4	0
KARNES	0	7	0	0	1	5	0	0
KAUFMAN	20	118	28	8	5	15	79	194
KENDALL	0	0	0	0	0	0	0	9
KENEDY	0	0	0	0	0	1	0	0

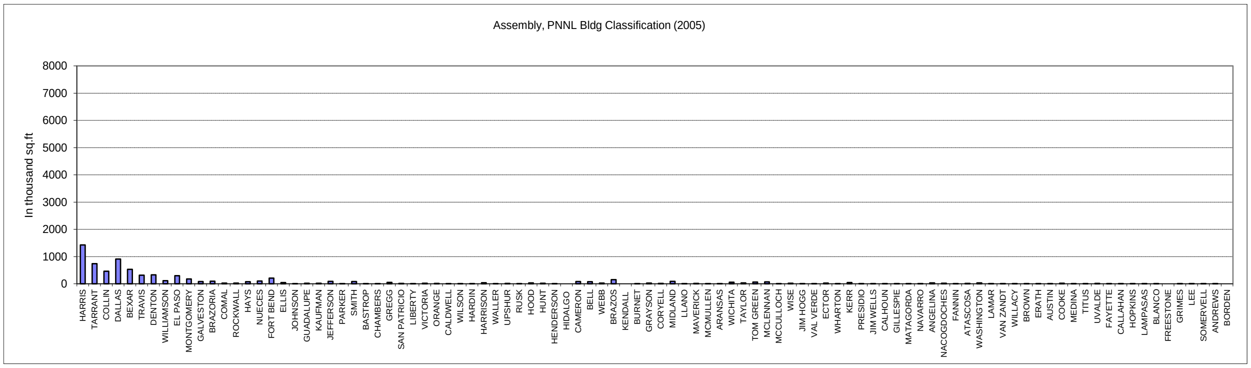
[38] Source: Dodge/McGraw-Hill 2007

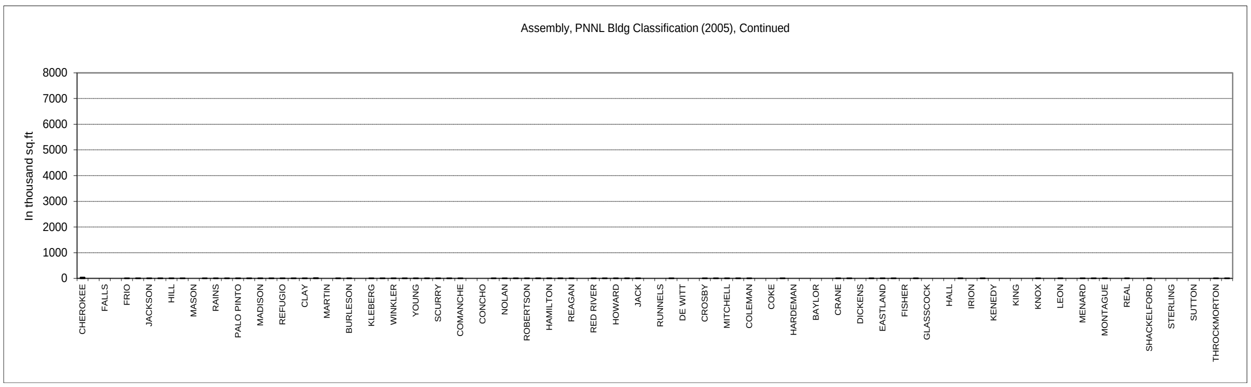
Table 34: 2010 New Commercial Building Constructions (sq. ft. x 1000) [39]

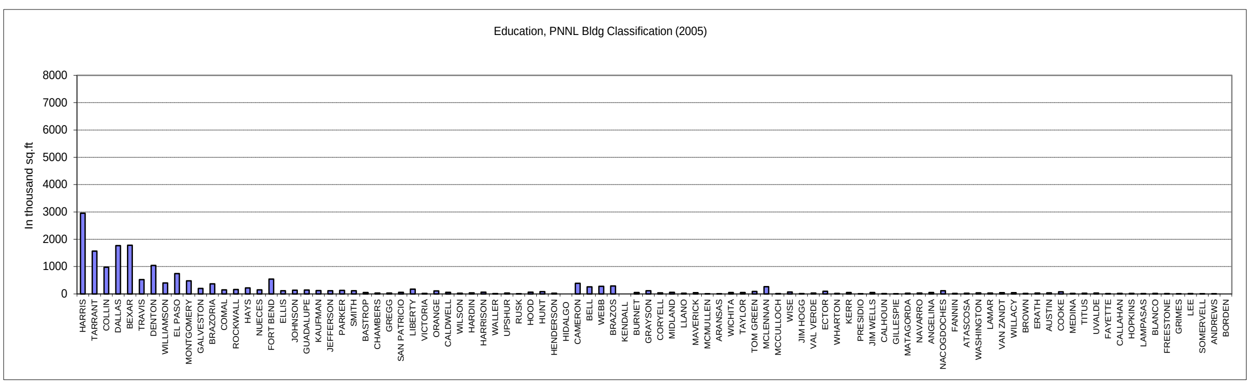
Table shows Dodge (2005) data merged into PNNL building types (sq. ft. x 1000) (Part 3)

ERCOT Counties	Assembly	Education	Retail	Food	Lodging	Office	Warehouse	Stores and Restaurants
KENT	0	0	0	0	2	0	0	0
KERR	43	50	23	6	53	26	0	0
KIMBLE	2	0	0	0	0	2	0	0
KING	0	0	0	0	0	0	0	0
KINNEY	0	3	0	0	0	23	0	0
KLEBERG	6	38	33	9	8	6	1	160
KNOX	1	1	0	0	0	0	0	0
LA SALLE	0	1	0	0	2	0	0	0
LAMAR	4	29	5	1	2	5	2	10
LAMPASAS	2	9	12	3	7	4	0	2
LAVACA	7	2	0	0	1	2	0	0
LEE	1	13	1	0	0	5	0	12
LEON	7	7	0	0	0	0	0	0
LIMESTONE	3	5	9	2	4	9	0	0
LIVE OAK	10	0	0	0	0	0	0	0
LLANO	1	24	0	0	56	4	0	0
LOVING	0	0	0	0	0	0	0	0
MADISON	1	10	0	0	0	0	0	0
MARTIN	0	0	0	0	0	0	0	0
MASON	0	1	0	0	0	2	0	0
MATAGORDA	4	26	5	1	9	6	7	0
MAVERICK	13	41	12	3	28	24	1	30
MCCULLOCH	0	9	0	0	0	0	0	0
MCLENNAN	71	266	99	26	122	92	121	148
MCMULLEN	2	1	0	0	0	1	0	0
MEDINA	3	20	1	0	0	11	1	0
MENARD	0	1	0	0	0	0	0	0
MIDLAND	88	59	89	24	51	59	18	188
MILAM	3	39	10	3	0	19	0	100
MILLS	2	8	0	0	0	1	0	0
MITCHELL	4	0	0	0	5	14	0	0
MONTAGUE	1	13	10	3	6	5	1	100
MONTGOMERY	0	0	0	0	0	0	0	452
MOTLEY	0	1	0	0	0	0	0	0
NACOGDOCHES	22	117	19	5	27	14	13	0
NAVARRO	3	30	18	5	14	2	34	215
NOLAN	6	17	10	3	8	0	0	100
NUECES	0	0	0	0	0	0	0	103
PALO PINTO	4	26	15	4	3	2	2	203
PARKER	10	130	71	19	37	8	6	532
PECOS	3	6	0	0	9	11	0	0
PRESIDIO	3	5	0	0	0	1	0	0
RAINS	1	8	0	0	0	1	0	0
REAGAN	1	0	0	0	0	8	0	0
REAL	0	1	0	0	4	1	0	0
RED RIVER	2	14	0	0	0	0	0	0
REEVES	5	2	0	0	4	47	0	5
REFUGIO	1	1	0	0	0	2	0	0
ROBERTSON	1	3	0	0	1	0	1	0
ROCKWALL	26	158	95	25	15	26	36	152
RUNNELS	0	6	1	0	0	2	0	0
RUSK	1	6	11	3	1	2	2	140
SAN PATRICIO	13	56	23	6	19	75	241	161
SAN SABA	4	3	1	0	0	0	0	0
SCHLEICHER	0	0	0	0	0	0	0	0
SCURRY	1	0	4	1	2	1	12	0
SHACKELFORD	2	4	0	0	2	0	0	0
SMITH	80	113	87	23	120	121	147	64
SOMERVELL	0	7	0	0	1	5	1	0
STARR	0	0	0	0	0	0	0	0
STEPHENS	0	6	0	0	1	0	0	0
STERLING	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0
SUTTON	0	2	0	0	1	1	0	0
TARRANT	737	1,564	1,667	445	1,003	902	1,875	2,836
TAYLOR	34	49	80	21	60	32	52	384
TERRELL	0	0	0	0	0	6	0	0
THROCKMORTON	1	0	0	0	0	1	0	0
TITUS	4	26	7	2	0	2	0	0
TOM GREEN	61	89	52	14	112	40	33	158
TRAVIS	315	525	646	172	652	527	398	1,436
UPTON	0	0	0	0	0	0	0	0
UVALDE	14	32	33	9	5	7	8	236
VAL VERDE	9	29	7	2	9	27	3	5
VAN ZANDT	1	41	0	0	0	1	0	0
VICTORIA	0	0	0	0	0	0	0	15
WALLER	3	12	0	0	0	0	14	22
WARD	0	0	0	0	0	7	0	0
WASHINGTON	30	36	33	9	12	13	25	253
WEBB	28	275	53	14	95	78	118	33
WHARTON	9	16	30	8	6	6	11	29
WICHITA	59	50	51	13	165	57	28	103
WILBARGER	3	7	9	2	11	17	1	0
WILLACY	2	42	27	7	1	26	7	4
WILLIAMSON	116	399	305	81	123	134	119	946
WILSON	0	0	0	0	0	0	0	74
WINKLER	1	0	0	0	0	0	0	0
WISE	18	73	1	0	47	19	0	0
YOUNG	10	21	23	6	6	4	2	0
ZAPATA	2	40	1	0	1	12	0	0
ZAVALA	0	5	0	0	1	1	0	0
TOTAL (ERCOT COUNTIES)	5,290	13,900	9,756	2,603	7,815	7,821	11,452	26,415

[39] Source: Dodge/McGraw-Hill 2007







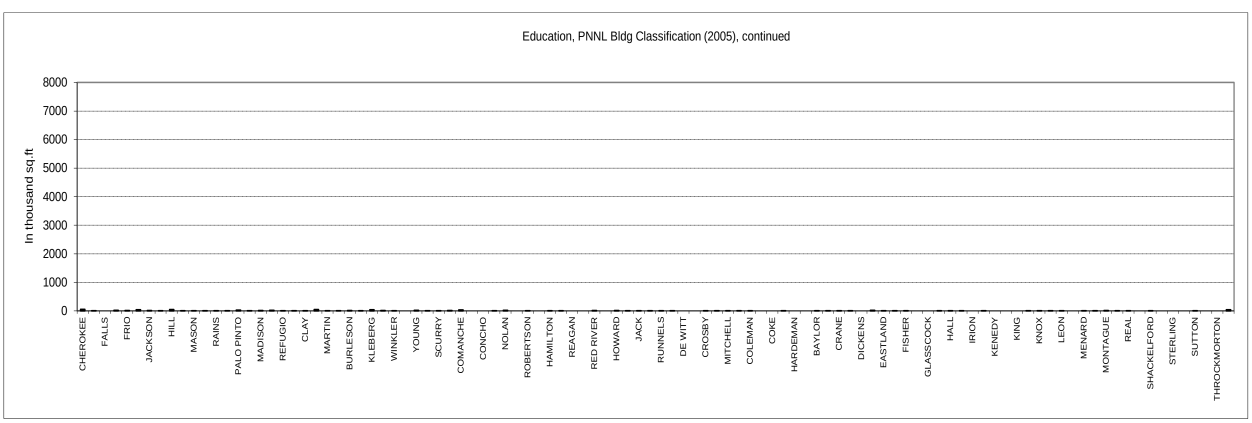
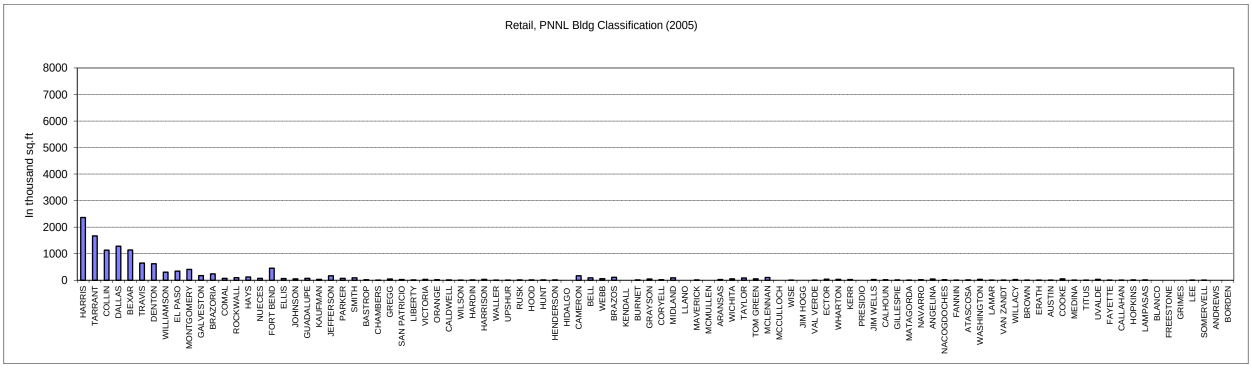
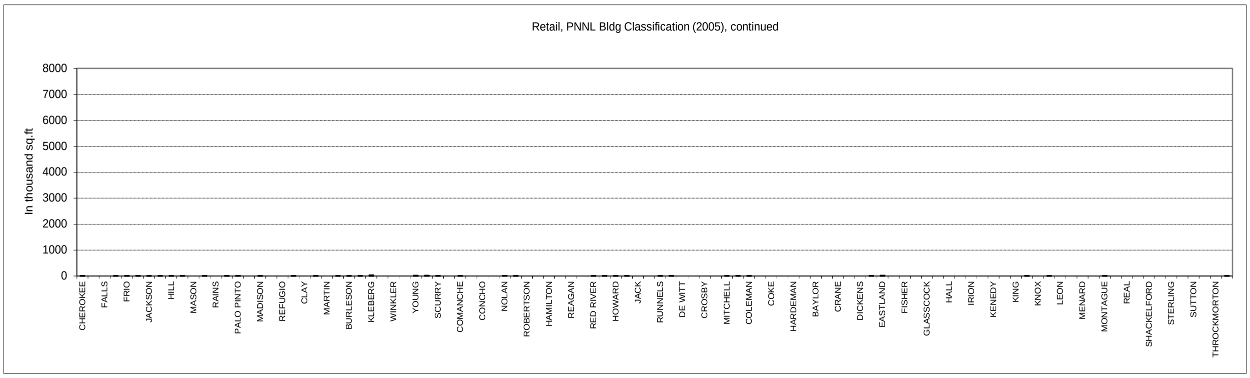
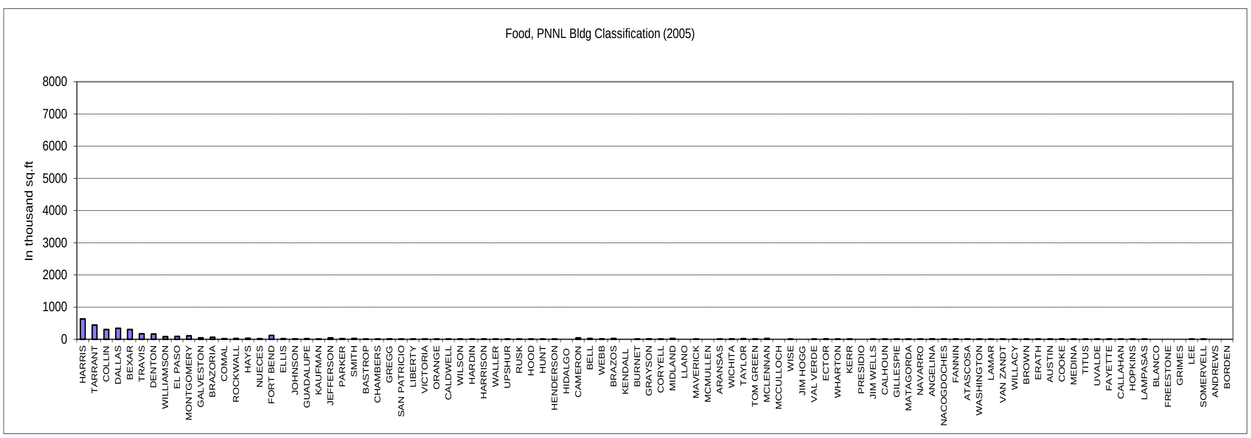


Figure 150: 2010 New Commercial Building Constructions (sq. ft. x 1000), Part 1 (Dodge 2005)







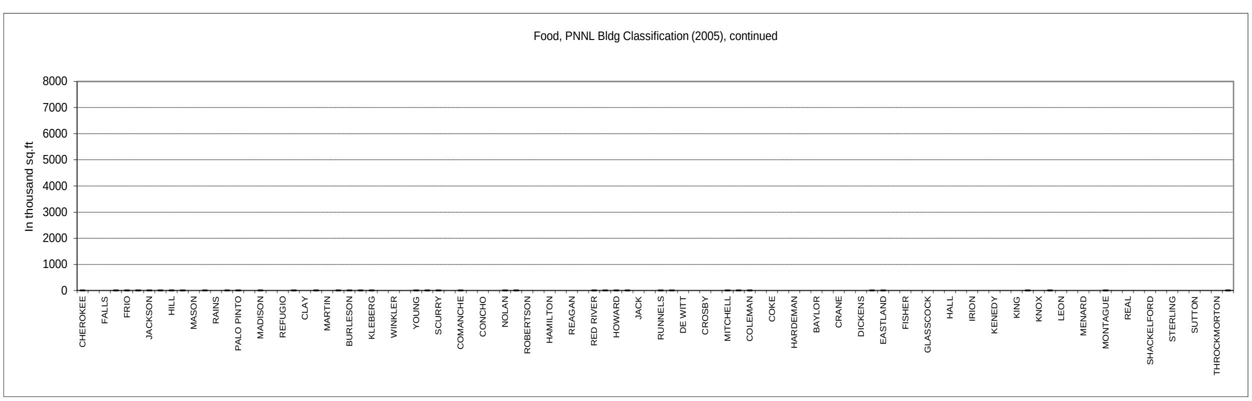
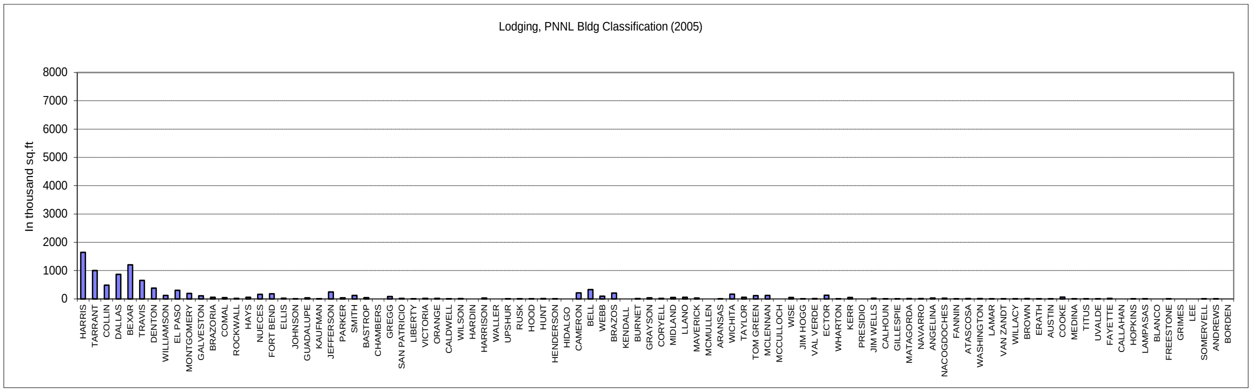
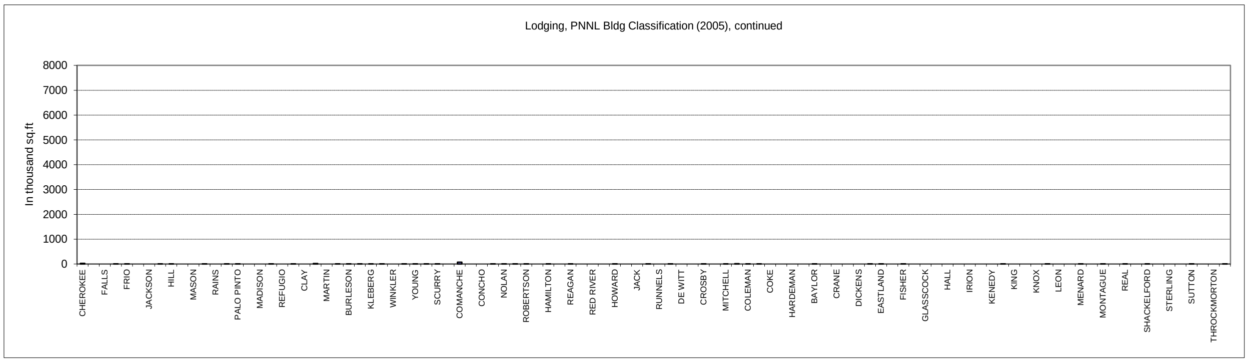
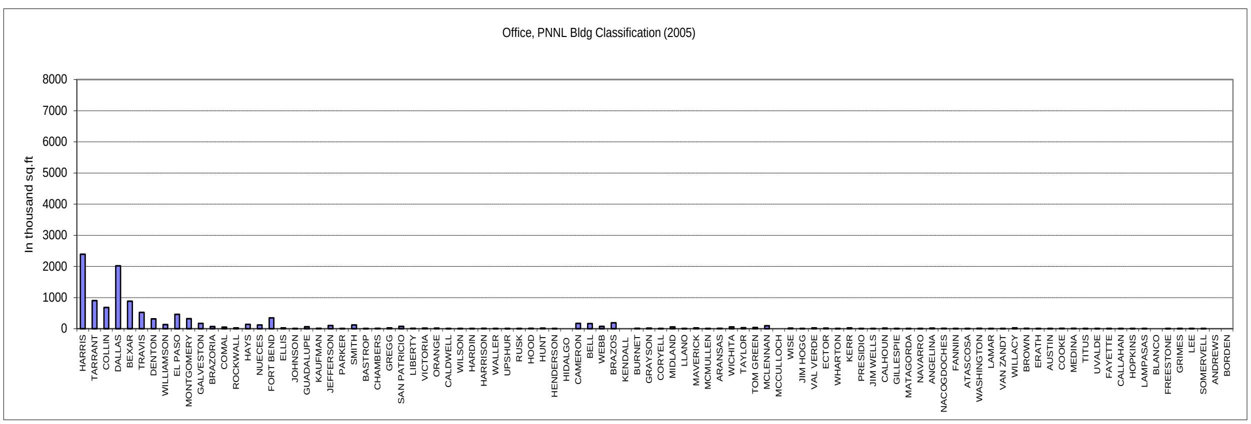


Figure 151: 2010 New Commercial Building Constructions (sq. ft. x 1000), Part 2 (Dodge 2005)







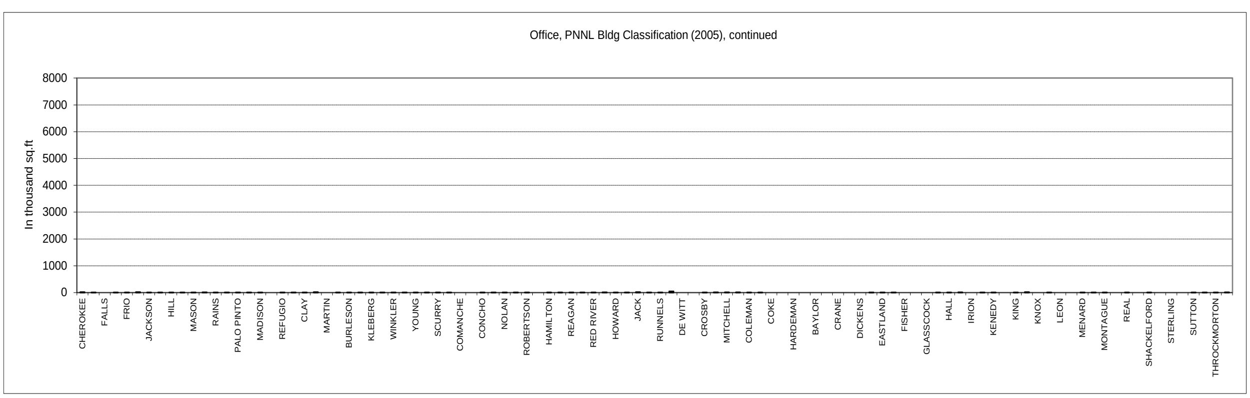
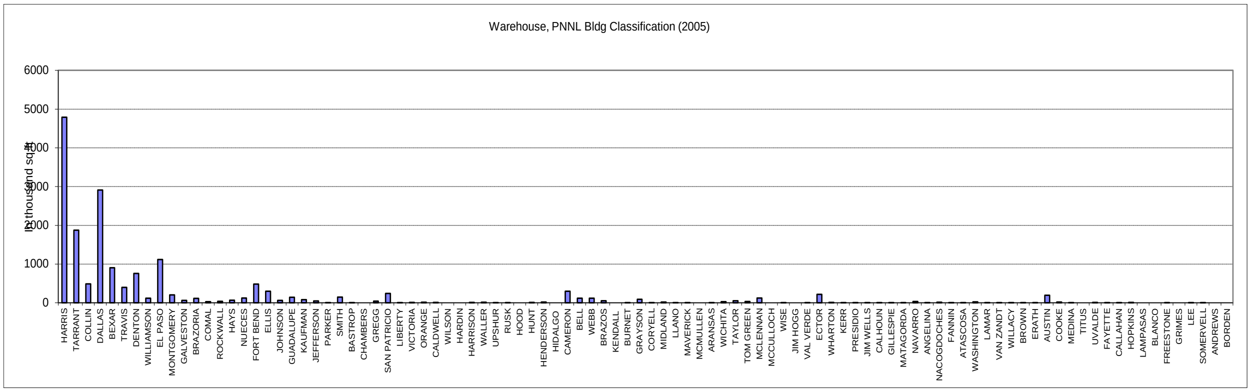


Figure 152: 2010 New Commercial Building Constructions (sq. ft. x 1000), Part 3 (Dodge 2005)



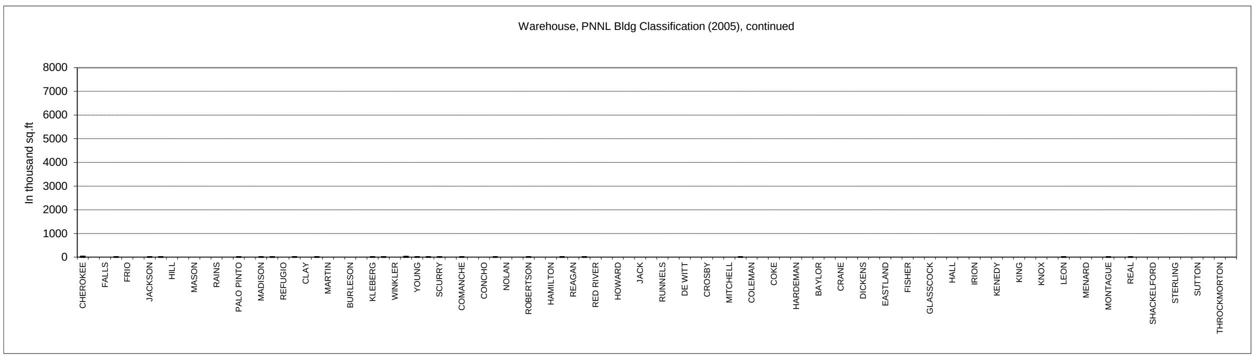


Figure 153: 2010 New Commercial Building Constructions (sq. ft. x 1000), Part 4(Dodge 2005)

Table 35: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USDOE 2004) (Part 1)

Assembly

Non-attainment Counties	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Brazoria	94	1676521	5640.9	1517449	4828	3019	5	3178	2
Chambers	7	121565	409.0	110031	350	219	0	230	0
Collin	459	8211993	27630.3	7432821	23650	14786	23	15567	10
Dallas	909	16249127	54672.3	14707374	46797	29257	45	30803	19
Denton	327	5848082	19676.6	5293203	16842	10530	16	11086	7
El Paso	295	5266305	17719.2	4766627	15167	9482	15	9983	6
Fort Bend	211	3763926	12664.2	3406796	10840	6777	10	7135	4
Galveston	84	1500463	5048.5	1358096	4321	2702	4	2844	2
Hardin	6	111361	374.7	100795	321	201	0	211	0
Harris	1424	25443486	85607.9	23029352	73277	45812	71	48232	30
Jefferson	88	1576170	5303.2	1426619	4539	2838	4	2988	2
Liberty	5	83894	282.3	75934	242	151	0	159	0
Montgomery	176	3142465	10573.2	2844301	9050	5658	9	5957	4
Orange	11	198199	666.9	179393	571	357	1	376	0
Tarrant	737	13173191	44322.9	11923290	37939	23719	37	24972	15
Waller	3	55885	188.0	50582	161	101	0	106	0
Total (Non-attainment)	4836	86422633	290780	78222663	248896	155608	240	163829	101

Education

Non-attainment Counties	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Brazoria	366	3785990	12738	3354823	10675	6898	11	7333	5
Chambers	33	346585	1166	307114	977	631	1	671	0
Collin	974	10083496	33927	8935137	28431	18371	28	19530	12
Dallas	1769	18307345	61597	16222414	51618	33354	51	35459	22
Denton	1041	10777562	36263	9550160	30388	19636	30	20875	13
El Paso	746	7724164	25989	6844497	21778	14073	22	14961	9
Fort Bend	546	5646948	19000	5003845	15922	10288	16	10937	7
Galveston	197	2038584	6859	1806420	5748	3714	6	3948	2
Hardin	38	394860	1329	349892	1113	719	1	765	0
Harris	2949	30530802	102725	27053802	86082	55625	86	59134	37
Jefferson	117	1215416	4089	1076998	3427	2214	3	2354	1
Liberty	171	1765150	5939	1564126	4977	3216	5	3419	2
Montgomery	477	4933359	16599	4371523	13910	8988	14	9555	6
Orange	107	1102776	3710	977187	3109	2009	3	2136	1
Tarrant	1564	16186680	54462	14343260	45639	29491	45	31352	19
Waller	12	121569	409	107724	343	221	0	235	0
Total (Non-attainment)	11106	114961287	386802	101868922	324135	209450	322	222666	138

Retail

Non-attainment Counties	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Brazoria	237	3936500	13245	3316470	10553	937	1	1227	1
Chambers	5	85951	289	72413	230	20	0	27	0
Collin	1131	18764361	63135	15808827	50302	4467	7	5847	4
Dallas	1283	21286842	71622	17933997	57064	5068	8	6633	4
Denton	621	10304989	34672	8681872	27625	2453	4	3211	2
El Paso	343	5693033	19155	4796336	15261	1355	2	1774	1
Fort Bend	454	7539432	25367	6351912	20211	1795	3	2349	1
Galveston	173	2868610	9652	2416781	7690	683	1	894	1
Hardin	13	217605	732	183331	583	52	0	68	0
Harris	2360	39158503	131754	32990731	104973	9322	14	12202	8
Jefferson	165	2739476	9217	2307987	7344	652	1	854	1
Liberty	13	216065	727	182033	579	51	0	67	0
Montgomery	408	6769525	22777	5703271	18147	1612	2	2109	1
Orange	17	290106	976	244412	778	69	0	90	0
Tarrant	1667	27652878	93042	23297332	74129	6583	10	8617	5
Waller	0	8266	28	6964	22	2	0	3	0
Total (Non-attainment)	8892	147532142	496391	124294667	395491	35123	54	45971	28

Assembly

Affected Counties	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Bastrop	5	97542	328.2	88287	281	176	0	185	0
Bexar	532	9511289	32002.0	8608837	27392	17126	26	18030	11
Caldwell	2	37358	125.7	33813	108	67	0	71	0
Comal	25	444257	1494.8	402105	1279	800	1	842	1
Ellis	46	818987	2755.6	741280	2359	1475	2	1553	1
Gregg	48	859056	2890.4	777547	2474	1547	2	1628	1
Guadalupe	21	372804	1254.3	337431	1074	671	1	707	0
Harrison	39	704949	2371.9	638062	2030	1269	2	1336	1
Hays	75	1333807	4487.8	1207252	3841	2402	4	2528	2
Henderson	4	75569	254.3	68399	218	136	0	143	0
Hood	34	609755	2051.6	551901	1756	1098	2	1156	1
Hunt	17	295412	994.0	267383	851	532	1	560	0
Johnson	9	168450	566.8	152467	485	303	0	319	0
Kaufman	20	351861	1183.9	318475	1013	634	1	667	0
Nueces	102	1814053	6103.6	1641932	5224	3266	5	3439	2
Parker	10	170394	573.3	154227	491	307	0	323	0
Rockwall	26	472358	1589.3	427540	1360	851	1	895	1
Rusk	1	10290	34.6	9314	30	19	0	20	0
San Patricio	13	237634	799.6	215087	684	428	1	450	0
Smith	80	1423915	4790.9	1288811	4101	2564	4	2699	2
Travis	315	5624194	18923.3	5090558	16198	10127	16	10662	7
Upshur	11	194637	654.9	176170	561	350	1	369	0
Victoria	17	303662	1021.7	274850	875	547	1	576	0
Williamson	116	2080761	7001.0	1883333	5993	3747	6	3944	2
Wilson	2	40072	134.8	36270	115	72	0	76	0
Total (Affected)	1570	28053066	94388	25391329	80792	50511	78	53179	33

Education

Affected Counties	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Bastrop	53	547404	1842	485063	1543	997	2	1060	1
Bexar	1781	18434651	62026	16335221	51977	33586	52	35706	22
Caldwell	60	616464	2074	546258	1738	1123	2	1194	1
Comal	145	1495954	5033	1325587	4218	2726	4	2897	2
Ellis	117	1208903	4068	1071227	3409	2203	3	2341	1
Gregg	33	346554	1166	307087	977	631	1	671	0
Guadalupe	140	1453668	4891	1288117	4099	2648	4	2816	2
Harrison	61	632144	2127	560152	1782	1152	2	1224	1
Hays	219	2263435	7616	2005664	6382	4124	6	4384	3
Henderson	21	218288	734	193429	615	398	1	423	0
Hood	62	640323	2154	567400	1805	1167	2	1240	1
Hunt	80	828602	2788	734237	2336	1510	2	1605	1
Johnson	134	1384855	4660	1227141	3905	2523	4	2682	2
Kaufman	118	1225788	4124	1086189	3456	2233	3	2374	1
Nueces	150	1557085	5239	1379756	4390	2837	4	3016	2
Parker	130	1346966	4532	1193567	3798	2454	4	2609	2
Rockwall	158	1632628	5493	1446696	4603	2975	5	3162	2
Rusk	6	63102	212	55916	178	115	0	122	0
San Patricio	56	583636	1964	517168	1646	1063	2	1130	1
Smith	113	1174684	3952	1040906	3312	2140	3	2275	1
Travis	525	5430906	18273	4812407	15313	9895	15	10519	6
Upshur	29	298730	1005	264709	842	544	1	579	0
Victoria	16	167296	563	148243	472	305	0	324	0
Williamson	399	4130519	13898	3660115	11646	7525	12	8000	5
Wilson	24	248006	834	219762	699	452	1	480	0
Total (Affected)	4630	47930590	161269	42472015	135141	87326	134	92836	57

Retail

Affected Counties	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Bastrop	16	268439	903	226157	720	64	0	84	0
Bexar	1141	18937531	63718	15954721	50766	4508	7	5901	4
Caldwell	12	200847	676	169212	538	48	0	63	0
Comal	71	1179079	3967	993364	3161	281	0	367	0
Ellis	63	1041359	3504	877337	2792	248	0	324	0
Gregg	45	743451	2501	626352	1993	177	0	232	0
Guadalupe	69	1147425	3861	966697	3076	273	0	358	0
Harrison	32	532576	1792	448691	1428	127	0	166	0
Hays	121	2003494	6741	1687928	5371	477	1	624	0
Henderson	9	147716	497	124449	396	35	0	46	0
Hood	12	206282	694	173791	553	49	0	64	0
Hunt	14	231671	779	195181	621	55	0	72	0
Johnson	51	848104	2854	714521	2274	202	0	264	0
Kaufman	28	472862	1591	398383	1268	113	0	147	0
Nueces	70	1161107	3907	978224	3113	276	0	362	0
Parker	71	1170704	3939	986309	3138	279	0	365	0
Rockwall	95	1582511	5325	1333253	4242	377	1	493	0
Rusk	11	177507	597	149548	476	42	0	55	0
San Patricio	23	378735	1274	319082	1015	90	0	118	0
Smith	87	1441125	4849	1214136	3863	343	1	449	0
Travis	646	10715898	36055	9028059	28726	2551	4	3339	2
Upshur	4	62400	210	52572	167	15	0	19	0
Victoria	29	485664	1634	409168	1302	116	0	151	0
Williamson	305	5062247	17033	4264903	13570	1205	2	1577	1
Wilson	5	77288	260	65114	207	18	0	24	0
Total (Affected)	3030	50276024	169160	42357154	134776	11969	18	15666	10

Table 36: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USDOE 2004) (Part 2)

ERCOT Counties	Assembly									Education										Retail									
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
ANDERSON	1	22657	76.2	20507	65	41	0	43	0	1	10260	35	9092	29	19	0	20	0	2	33980	114	28628	91	8	0	11	0
ANDREWS	1	11949	40.2	10815	34	22	0	23	0	6	58202	196	51573	164	106	0	113	0	0	0	0	0	0	0	0	0	0
ANGELINA	33	596317	2006.4	539737	1717	1074	2	1130	1	53	548779	1846	486282	1547	1000	2	1063	1	45	753098	2534	634480	2019	179	0	235	0
ARANSAS	4	71112	239.3	64365	205	128	0	135	0	1	14463	49	12816	41	26	0	28	0	26	438058	1474	369060	1174	104	0	136	0
ARCHER	1	22097	74.3	20000	64	40	0	42	0	17	177212	596	157031	500	323	0	343	0	0	0	0	0	0	0	0	0	0
ATASCOSA	11	203235	683.8	183952	585	366	1	385	0	21	217377	731	192621	613	396	1	421	0	11	187293	630	157793	502	45	0	58	0
AUSTIN	1	9965	33.5	9019	29	18	0	19	0	38	390934	1315	346412	1102	712	1	757	0	1	12949	44	10909	35	3	0	4	0
BANDERA	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	0	0	0.0	0	0	0	0	0	0	1	13545	46	12002	38	25	0	26	0	0	0	0	0	0	0	0	0	0
BEE	19	340565	1145.9	308251	981	613	1	646	0	49	505963	1702	448341	1427	922	1	980	1	5	91052	306	76711	244	22	0	28	0
BELL	78	1389922	4676.6	1258043	4003	2503	4	2635	2	257	2664897	8966	2361405	7514	4855	7	5162	3	88	1458600	4908	1228859	3910	347	1	454	0
Bexar	532	9511289	32002.0	8608837	27392	17126	26	18030	11	1781	18434651	62026	16335221	51977	33586	52	35706	22	1141	18937531	63718	15954721	50766	4508	7	5901	4
BLANCO	0	2511	8.4	2273	7	5	0	5	0	18	182545	614	161756	515	333	1	354	0	0	0	0	0	0	0	0	0	0
BORDEN	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	1	16718	56.2	15132	48	30	0	32	0	16	166996	562	147978	471	304	0	323	0	0	0	0	0	0	0	0	0	0
Brazoria	94	1676521	5640.9	1517449	4828	3019	5	3178	2	366	3785990	12738	3354823	10675	6898	11	7333	5	237	3936500	13245	3316470	10553	937	1	1227	1
BRAZOS	150	2675710	9002.8	2421833	7706	4818	7	5072	3	293	3032776	10204	2687388	8551	5525	9	5874	4	106	1753685	5901	1477465	4701	417	1	546	0
BREWSTER	4	78573	264.4	71118	226	141	0	149	0	11	110667	372	98063	312	202	0	214	0	0	0	0	0	0	0	0	0	0
BRISCOE	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	0	3191	10.7	2889	9	6	0	6	0	0	0	0	0	0	0	0	0	0	0	7877	27	6636	21	2	0	2	0
BROWN	5	97218	327.1	87994	280	175	0	184	0	15	153228	516	135777	432	279	0	297	0	8	128186	431	107996	344	31	0	40	0
BURLESON	1	20479	68.9	18536	59	37	0	39	0	12	122631	413	108665	346	223	0	238	0	1	8495	29	7157	23	2	0	3	0
BURNET	7	120960	407.0	109483	348	218	0	229	0	51	528463	1778	468279	1490	963	1	1024	1	10	168145	566	141661	451	40	0	52	0
Caldwell	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	0	797	2.7	721	2	1	0	2	0	11	114579	386	101530	323	209	0	222	0	18	302450	1018	254812	811	72	0	94	0
CALLAHAN	3	50151	168.7	45393	144	90	0	95	0	18	181279	610	160634	511	330	1	351	0	0	4016	14	3383	11	1	0	1	0
CAMERON	80	1429686	4810.4	1294034	4117	2574	4	2710	2	390	4036917	13583	3577172	11382	7355	11	7819	5	169	2797914	9414	2357221	7500	666	1	872	1
Chambers	7	121565	409.0	110031	350	219	0	230	0	33	346585	1166	307114	977	631	1	671	0	5	85951	289	72413	230	20	0	27	0
CHEROKEE	37	654229	2201.2	592154	1884	1178	2	1240	1	56	579037	1948	513094	1633	1055	2	1122	1	10	160208	539	134974	429	38	0	50	0
CHILDRESS	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	0	6687	22.5	6053	19	12	0	13	0	3	34255	115	30354	97	62	0	66	0	0	0	0	0	0	0	0	0	0
COKE	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	1	15629	52.6	14146	45	28	0	30	0	1	15299	51	13557	43	28	0	30	0	0	2433	8	2050	7	1	0	1	0
Collin	459	8211993	27630.3	7432821	23650	14786	23	15567	10	974	10083496	33927	8935137	28431	18371	28	19530	12	1131	18764361	63135	15808827	50302	4467	7	5847	4
COLORADO	0	0	0.0	0	0	0	0	0	0	17	175440	590	155460	495	320	0	340	0	0	3736	13	3147	10	1	0	1	0
Comal	25	444257	1494.8	402105	1279	800	1	842	1	145	1495954	5033	1325587	4218	2726	4	2897	2	71	1179079	3967	993364	3161	281	0	367	0
COMANCHE	7	124622	419.3	112798	359	224	0	236	0	36	376215	1266	333370	1061	685	1	729	0	1	17608	59	14834	47	4	0	5	0
CONCHO	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	21	384248	1292.9	347789	1107	692	1	728	0	76	788052	2652	698305	2222	1436	2	1526	1	50	831672	2798	700677	2229	198	0	259	0
CORYELL	13	233140	784.4	211019	671	420	1	442	0	35	360748	1214	319664	1017	657	1	699	0	19	316953	1066	267031	850	75	0	99	0
COTTLE	0	0	0.0	0	0	0	0	0	0	2	15771	53	13975	44	29	0	31	0	0	0	0	0	0	0	0	0	0
CRANE	1	26794	90.2	24252	77	48	0	51	0	1	15042	51	13329	42	27	0	29	0	0	0	0	0	0	0	0	0	0
CROCKETT	3	53522	180.1	48444	154	96	0	101	0	2	16699	56	14797	47	30	0	32	0	0	0	0	0	0	0	0	0	0
CROSBY	1	12762	42.9	11552	37	23	0	24	0	0	2227	7	1973	6	4	0	4	0	0	0	0	0	0	0	0	0	0
CULBERSON	1	12158	40.9	11005	35	22	0	23	0	8	86206	290	76388	243	157	0	167	0	0	6178	21	5205	17	1	0	2	0
Dallas	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	0	7110	23.9	6435	20	13	0	13	0	7	69580	234	61656	196	127	0	135	0	0	0	0	0	0	0	0	0	0
DE WITT	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	0	4103	13.8	3714	12	7	0	8	0	3	27275	92	24169	77	50	0	53	0	0	0	0	0	0	0	0	0	0
Denton	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	0.0	0	0	0	0	0	0	3	27056	91	23975	76	49	0	52	0	0	0	0	0	0	0	0	0	0
DUVAL	0	3799	12.8	3439	11	7	0	7	0	20	211498	712	187412	596	385	1	410	0	1	13038	44	10985	35	3	0	4	0
EASTLAND	7	127633	429.4	115523	368	230	0	242	0	4	38973	131	34535	110	71	0	75	0	20	328893	1107	277090	882	78	0	102	0
ECTOR	28	496586	1670.8	449469	1430	894	1	941	1	92	956241	3217	847339	2696	1742	3	1852	1	38	632430	2128	532817	1695	151	0	197	0
EDWARDS	0	2736	9.2	2476	8	5	0	5	0	0	4824	16	4275	14	9	0	9	0	0	0	0	0	0	0	0	0	0
Ellis	46	818987	2755.6	741280	2359	1475	2	1553	1	117	1208903	4068	1071227	3409	2203	3	2341	1	63	1041359	3504	877337	2792	248	0	324	0
ERATH	4	75155	252.9	68024	216	135	0	142	0	31	320569	1079	284061	904	584	1	621	0	2	39999	135	33699	107	10	0	12	0
FALLS	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	6	101053	340.0	91465	291	182	0	192	0	20	211108	710	187066	595	385	1	409	0	3	51090	172	43043	137	12	0	16	0
FAYETTE	2	37593	126.5	34026	108	68	0	71	0	14	145633	490	129048	411	265	0	282	0	3	47377	159	39915	127	11	0	15	0
FISHER	0	0	0.0	0	0	0	0	0	0	3	35161	118	31157	99	64	0	68	0	0	0	0	0	0	0	0	0	0
FOARD	0	3169	10.7	2869	9	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fort Bend	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	0	6927	23.3	6270	20	12	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FREESTONE	0	0	0.0	0	0	0	0	0	0	8	85916	289	76132	242	157	0	166	0	0	0	0	0	0	0	0	0	0
FRIO	0	8931	30.0	8083	26	16	0	17	0	16	160971	542	142639	454	293	0	312	0	4	62766	211	52879	168	15	0	20	0
Galveston	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	8	134757	453.4	121971	388	243	0	255	0	6	57087	192	50585	161	104	0	111	0	13	208982	703	176066	560	50	0	65	0
GLASSCOCK	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	0.0	0	0	0	0	0	0	4	45234	152	40083	128	82	0	88	0	0	0	0	0	0	0	0	0	0
GONZALES	0	8812	29.6	7975	25	16	0	17	0	4	40649	137	36019	115	74	0	79	0	1	14678	49	12366	39	3	0	5	0
GRAYSON	25	454792	1530.2	411640	1310	819	1	862	1	113	1167263	3927	1034329	3291	2127	3	2261	1	43	720274	2423	606825	1931	171	0	224	0
GRIMES	3	53156	178.9	48113	153	96	0	101	0	8	78902	265	69916	222	144	0	153	0	0	0	0	0	0	0	0	0	0
Guadalupe	21	372804	1254.3	337431	1074	671	1	707	0	140	1453668	4891	1288117	4099	2648	4	2816	2	69	1147425	3861	966697	3076	273	0	358	0
HALL	0	0	0.0	0	0	0	0	0	0	1	5566	19	4933	16	10	0	11	0	0	0	0	0	0	0	0	0	0
HAMILTON	0	6079	20.5	5502	18	11	0	12	0	6	60442	203	53558	170	110	0	117	0	0	0	0	0	0	0	0	0	0
HARDEMAN	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	1424	25443486	85607.9	23029352	73277	45812	71	48232	30	2949	30530802	102725	27053802	86082	55625	86	59134	37	2360	39158503	131754	32990731	104973	9322	14	12202	8
HASKELL	0	3040	10.2	2751	9	5	0	6	0	0	0	0	0	0	0	0	0	0	9	142865	481	120362	383	34	0	45	0
Hays	75	1333807	4487.8	1207252	3841	2402	4	2528	2	219	2263435	7616	2005664	6382	4124	6	4384	3	121	2003494	6741	1687928	5371	477	1	624	0
Henderson	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	4	74779	251.6	67684	215	135	0	142	0	49	509749	1715	451696	1437	929	1	987	1	7	115486	389	97296	310	27	0	36	0
Hood	34	609755	2051.6	551901	1756	1098	2	1156	1	62	640323	2154	567400	1805	1167	2	1240	1	12	206282	694	173791	553	49	0	64	0
HOPKINS	5	89866	302.4	81339	259	162	0	170	0	17	171905	578	152328	485	313	0	333	0	10	169246	569	142588	454	40	0	53	0
HOUSTON	2	32935	110.8	29811	95	59	0	62	0	5	56468	190	50037	159	103	0	109	0	17	287444	967	242169	771	68	0	90	0
HOWARD	4	74809	251.7	67711	215	135	0	142	0	10	104544	352	92638	295	190	0	202	0	1	18200	61	15333	49	4	0	6	0
HUDSPETH	1	11622	39.1	10520	33	21	0	22	0	9	89856	302	79623	253	164	0	174	0	0	0	0	0	0	0	0	0	0
Hunt	17	295412	994.0	267383	851	532	1	560	0	80	828602	2788	734237	2336	1510	2	1605	1	14	231671	779	195181	621	55	0	72	0
IRION	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	1	22797	76.7	20634	66	41	0	43	0	1	9834	33	8714	28	18	0	19	0	0	0	0	0	0	0	0	0	0
JACKSON	1	24198	81.4	21902	70	44	0	46	0	16	165915	558	147020	468	302	0	321	0	1	9571	32	8064	26	2	0	3	0
JEFF DAVIS	6	113331	381.3	102578	326	204	0	215	0	0	1484	5	1315	4	3	0	3	0	0	0	0	0	0	0	0	0	0
JIM HOGG	0	7655	25.8	6928	22	14	0	15	0	8	85554	288	75811	241	156	0	166	0	0	0	0	0	0	0	0	0	0

Table 37: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Assembly, Education, and Retail Building Types (USDOE 2004) (Part 3)

ERCOT Counties	Assembly									Education									Retail								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
JIM WELLS	0	3828	12.9	3465	11	7	0	7	0	47	489688	1648	433919	1381	892	1	948	1	22	357686	1203	301348	959	85	0	111	0
Johnson	9	168450	566.8	152467	485	303	0	319	0	134	1384855	4660	1227141	3905	2523	4	2682	2	51	848104	2854	714521	2274	202	0	264	0
JONES	8	144631	486.6	130908	417	260	0	274	0	8	87407	294	77452	246	159	0	169	0	0	0	0	0	0	0	0	0	0
KARNES	0	0	0.0	0	0	0	0	0	0	7	69397	233	61494	196	126	0	134	0	0	1843	6	1553	5	0	0	1	0
Kaufman	20	351861	1183.9	318475	1013	634	1	667	0	118	1225788	4124	1086189	3456	2233	3	2374	1	28	472862	1591	398383	1268	113	0	147	0
KENDALL	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KERR	43	759912	2556.8	687810	2189	1368	2	1441	1	50	513000	1726	454577	1446	935	1	994	1	23	374653	1261	315642	1004	89	0	117	0
KIMBLE	2	28876	97.2	26136	83	52	0	55	0	0	2783	9	2466	8	5	0	5	0	0	0	0	0	0	0	0	0	0
KING	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	0	0.0	0	0	0	0	0	0	3	31830	107	28205	90	58	0	62	0	0	7334	25	6179	20	2	0	2	0
KLEBERG	6	104819	352.7	94874	302	189	0	199	0	38	393893	1325	349035	1111	718	1	763	0	33	540651	1819	455495	1449	129	0	168	0
KNOX	1	15198	51.1	13756	44	27	0	29	0	1	12988	44	11509	37	24	0	25	0	0	0	0	0	0	0	0	0	0
LA SALLE	0	0	0.0	0	0	0	0	0	0	1	12865	43	11400	36	23	0	25	0	0	6642	22	5595	18	2	0	2	0
LAMAR	4	71970	242.2	65142	207	130	0	136	0	29	295471	994	261821	833	538	1	572	0	5	83467	281	70320	224	20	0	26	0
LAMPASAS	2	31745	106.8	28733	91	57	0	60	0	9	96596	325	85595	272	176	0	187	0	12	194288	654	163686	521	46	0	61	0
LAVACA	7	125704	422.9	113777	362	226	0	238	0	2	21179	71	18767	60	39	0	41	0	0	2343	8	1974	6	1	0	1	0
LEE	1	12379	41.7	11205	36	22	0	23	0	13	136482	459	120939	385	249	0	264	0	1	14982	50	12623	40	4	0	5	0
LEON	7	122663	412.7	111024	353	221	0	233	0	7	69157	233	61281	195	126	0	134	0	0	0	0	0	0	0	0	0	0
LIMESTONE	3	50862	171.1	46036	146	92	0	96	0	5	54694	184	48465	154	100	0	106	0	9	151293	509	127463	406	36	0	47	0
LIVE OAK	10	186022	625.9	168372	536	335	1	353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LLANO	1	10536	35.4	9536	30	19	0	20	0	24	250505	843	221976	706	456	1	485	0	0	0	0	0	0	0	0	0	0
LOVING	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	1	9848	33.1	8914	28	18	0	19	0	10	102171	344	90535	288	186	0	198	0	0	1030	3	868	3	0	0	0	0
MARTIN	0	0	0.0	0	0	0	0	0	0	0	4639	16	4110	13	8	0	9	0	0	0	0	0	0	0	0	0	0
MASON	0	0	0.0	0	0	0	0	0	0	1	11504	39	10194	32	21	0	22	0	0	0	0	0	0	0	0	0	0
MATAGORDA	4	66293	223.1	60003	191	119	0	126	0	26	268096	902	237564	756	488	1	519	0	5	76595	258	64531	205	18	0	24	0
MAVERICK	13	224837	756.5	203504	648	405	1	426	0	41	420833	1416	372906	1187	767	1	815	1	12	194059	653	163493	520	46	0	60	0
MCCULLOCH	0	7181	24.2	6500	21	13	0	14	0	9	98327	331	87129	277	179	0	190	0	0	0	0	0	0	0	0	0	0
MCLENNAN	71	1264507	4254.6	1144528	3642	2277	4	2397	1	266	2749028	9249	2435955	7751	5009	8	5325	3	99	1647523	5543	1388026	4417	392	1	513	0
MCMULLEN	2	39019	131.3	35317	112	70	0	74	0	1	6494	22	5754	18	12	0	13	0	0	0	0	0	0	0	0	0	0
MEDINA	3	58967	198.4	53372	170	106	0	112	0	20	207980	700	184294	586	379	1	403	0	1	14047	47	11834	38	3	0	4	0
MENARD	0	6063	20.4	5488	17	11	0	11	0	1	12255	41	10859	35	22	0	24	0	0	0	0	0	0	0	0	0	0
MIDLAND	88	1570456	5284.0	1421448	4523	2828	4	2977	2	59	607742	2045	538529	1714	1107	2	1177	1	89	1475546	4965	1243136	3956	351	1	460	0
MILAM	3	48633	163.6	44019	140	88	0	92	0	39	401493	1351	355769	1132	731	1	778	0	10	163494	550	137743	438	39	0	51	0
MILLS	2	29303	98.6	26522	84	53	0	56	0	8	82901	279	73460	234	151	0	161	0	0	0	0	0	0	0	0	0	0
MITCHELL	4	64548	217.2	58424	186	116	0	122	0	0	1577	5	1397	4	3	0	3	0	0	3475	12	2928	9	1	0	1	0
MONTAGUE	1	22501	75.7	20366	65	41	0	43	0	13	130667	440	115786	368	238	0	253	0	10	162490	547	136897	436	39	0	51	0
Montgomery	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	0.0	0	0	0	0	0	0	1	6587	22	5837	19	12	0	13	0	0	0	0	0	0	0	0	0	0
NACOGDOCHES	22	387336	1303.2	350584	1116	697	1	734	0	117	1212500	4080	1074415	3419	2209	3	2348	1	19	314772	1059	265193	844	75	0	98	0
NAVARRO	3	56233	189.2	50897	162	101	0	107	0	30	308983	1040	273794	871	563	1	598	0	18	294959	992	248501	791	70	0	92	0
NOLAN	6	99496	334.8	90056	287	179	0	189	0	17	178115	599	157830	502	325	0	345	0	10	170522	574	143663	457	41	0	53	0
Nueces	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	4	76832	258.5	69542	221	138	0	146	0	26	267664	901	237181	755	488	1	518	0	15	240710	810	202796	645	57	0	75	0
Parker	10	170394	573.3	154227	491	307	0	323	0	130	1346966	4532	1193567	3798	2454	4	2609	2	71	1170704	3939	986309	3138	279	0	365	0
PECOS	3	57633	193.9	52165	166	104	0	109	0	6	63842	215	56572	180	116	0	124	0	0	5642	19	4753	15	1	0	2	0
PRESIDIO	3	45915	154.5	41559	132	83	0	87	0	5	49955	168	44266	141	91	0	97	0	0	0	0	0	0	0	0	0	0
RAINS	1	10886	36.6	9853	31	20	0	21	0	8	83394	281	73897	235	152	0	162	0	0	0	0	0	0	0	0	0	0
REAGAN	1	25330	85.2	22927	73	46	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REAL	0	8055	27.1	7291	23	15	0	15	0	1	5937	20	5261	17	11	0	12	0	0	0	0	0	0	0	0	0	0
RED RIVER	2	29224	98.3	26451	84	53	0	55	0	14	141850	477	125695	400	258	0	275	0	0	1120	4	943	3	0	0	0	0
REEVES	5	87301	293.7	79017	251	157	0	165	0	2	19946	67	17675	56	36	0	39	0	0	8149	27	6866	22	2	0	3	0
REFUGIO	1	19462	65.5	17615	56	35	0	37	0	1	7904	27	7004	22	14	0	15	0	0	0	0	0	0	0	0	0	0
ROBERTSON	1	23405	78.7	21184	67	42	0	44	0	3	31888	107	28257	90	58	0	62	0	0	0	0	0	0	0	0	0	0
Rockwall	26	472358	1589.3	427540	1360	851	1	895	1	158	1632628	5493	1446696	4603	2975	5	3162	2	95	1582511	5325	1333253	4242	377	1	493	0
RUNNELS	0	0	0.0	0	0	0	0	0	0	6	62344	210	55244	176	114	0	121	0	1	12743	43	10736	34	3	0	4	0
Rusk	1	10290	34.6	9314	30	19	0	20	0	6	63102	212	55916	178	115	0	122	0	11	177507	597	149548	476	42	0	55	0
San Patricio	13	237634	799.6	215087	684	428	1	450	0	56	583636	1964	517168	1646	1063	2	1130	1	23	378735	1274	319082	1015	90	0	118	0
SAN SABA	4	76288	256.7	69050	220	137	0	145	0	3	27832	94	24662	78	51	0	54	0	1	12061	41	10161	32	3	0	4	0
SCHLEICHER	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	1	9645	32.5	8730	28	17	0	18	0	0	2598	9	2302	7	5	0	5	0	4	67189	226	56606	180	16	0	21	0
SHACKELFORD	2	32067	107.9	29025	92	58	0	61	0	4	40449	136	35843	114	74	0	78	0	0	0	0	0	0	0	0	0	0
Smith	80	1423915	4790.9	1288811	4101	2564	4	2699	2	113	1174684	3952	1040906	3312	2140	3	2275	1	87	1441125	4849	1214136	3863	343	1	449	0
SOMERVELL	0	4515	15.2	4087	13	8	0	9	0	7	69676	234	61741	196	127	0	135	0	0	2596	9	2187	7	1	0	1	0
STARR	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	0	0	0.0	0	0	0	0	0	0	6	61962	208	54905	175	113	0	120	0	0	0	0	0	0	0	0	0	0
STERLING	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	0	0	0.0	0	0	0	0	0	0	2	17163	58	15208	48	31	0	33	0	0	0	0	0	0	0	0	0	0
Tarrant	737	13173191	44322.9	11923290	37939	23719	37	24972	15	1564	16186680	54462	14343260	45639	29491	45	31352	19	1667	27652878	93042	23297332	74129	6583	10	8617	5
TAYLOR	34	603333	2030.0	546088	1738	1086	2	1144	1	49	509017	1713	451048	1435	927	1	986	1	80	1321963	4448	1113743	3544	315	0	412	0
TERRELL	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	1	18237	61.4	16507	53	33	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TITUS	4	77529	260.9	70173	223	140	0	147	0	26	266414	896	236073	751	485	1	516	0	7	112830	380	95058	302	27	0	35	0
TOM GREEN	61	1088975	3664.0	985651	3136	1961	3	2064	1	89	917348	3087	812876	2586	1671	3	1777	1	52	858726	2889	723470	2302	204	0	268	0
Travis	315	5624194	18923.3	5090558	16198	10127	16	10662	7	525	5430906	18273	4812407	15313	9895	15	10519	6	646	10715898	36055	9028059	28726	2551	4	3339	2
UPTON	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UVALDE	14	247696	833.4	224194	713	446	1	470	0	32	336383	1132	298074	948	613	1	652	0	33	548476	1845	462086	1470	131	0	171	0
VAL VERDE	9	157653	530.4	142695	454	284	0	299	0	29	301608	1015	267259	850	550	1	584	0	7	118083	397	99484	317	28	0	37	0
VAN ZANDT	1	25812	86.8	23363	74	46	0	49	0	41	421271	1417	373294	1188	768	1	816	1	0	2498	8	2105	7	1	0	1	0
Victoria	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	3	55885	188.0	50582	161	101	0	106	0	12	121569	409	107724	343	221	0	235	0	0	8266	28	6964	22	2	0	3	0
WARD	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	30	538405	1811.5	487320	1551	969	1	1021	1	36	371846	1251	329498	1048	677	1	720	0	33	552098	1858	465139	1480	131	0	172	0
WEBB	28	496008	1668.9	448946	1428	893	1	940	1	275	2844976	9572	2520976	8021	5183	8	5510	3	53	886532	2983	746896	2377	211	0	276	0
WHARTON	9	163879	551.4	148330	472	295	0	311	0	16	164564	554	145822	464	300	0	319	0	30	490695	1651	413407	1315	117	0	153	0
WICHITA	59	1055744	3552.2	955573	3041	1901	3	2001	1	50	518780	1746	459699	1463	945	1	1005	1	51	838701	2822	706599	2248	200	0	261	0
WILBARGER	3	54900	184.7	49691	158	99	0	104	0	7	71157	239	63054	201	130	0	138	0	9	143084	481	120547	384	34	0	45	0
WILLACY	2	33642	113.2	30450	97	61	0	64	0	42	434189	1461	384742	1224	791	1	841	1	27	440514	1482	371130	1181	105	0	137	0
Williamson	116	2080761	7001.0	1883333	5993	3747	6	3944	2	399	4130519	13898	3660115	11646	7525	12	8000	5	305	5062247	17033	4264903	13570	1205	2	1577	1
Wilson	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	1	15603	52.5	14123	45	28	0	30	0	0	2350	8	2083	7	4	0	5	0	0	0	0	0	0	0	0	0	0
WISE	18	326272	1097.8	295315	940	587	1	619	0	73	751659	2529	666056	2119	1369	2	1456	1	1	16045	54	13518	43	4	0	5	0
YOUNG	10	176112	592.6	159403	507	317	0	334	0	21	214119	720	189734	604	390	1	415	0	23	374023	1258	315112	1003	89	0	117	0
ZAPATA	2	39514	133.0	35765	114	71	0	75	0	40	417287	1404	369764	1177	760	1	808	0	1	13038	44	10985	35	3	0	4	0
ZAVALA	0	2206	7.4	1997	6	4	0	4	0	5	47261	159	41879	133	86	0	92	0	0	0	0	0	0	0	0	0	0
Total	5290	94536282	318080	85566471	272263	170217	262	179209	111	13900	143890166	484137	127503235	405701	262156	404	278697	172	9756	161871126	544637	136375149	433930	38537	59	50439	31

Table 38: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 1)

Non-attainment Counties	Food									Lodging									
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	
Brazoria	63	1867347	6283	1889034	6011	2248	3	2210	1	57	712562	2398	683260	2174	1010	2	914	1	
Chambers	1	40772	137	41246	131	49	0	48	0	0	0	0	0	0	0	0	0	0	
Collin	302	8901199	29949	9004579	28652	10717	17	10533	7	487	6048611	20351	5799883	18455	8571	13	7758	5	
Dallas	342	10097781	33975	10215059	32503	12158	19	11949	7	865	10748030	36163	10306055	32793	15230	23	13785	9	
Denton	166	4888349	16447	4945123	15735	5886	9	5784	4	383	4755051	15999	4559516	14508	6738	10	6099	4	
El Paso	92	2700589	9086	2731954	8693	3252	5	3196	2	300	3725876	12536	3572662	11368	5279	8	4779	3	
Fort Bend	121	3576460	12033	3617997	11512	4306	7	4232	3	182	2265983	7624	2172803	6914	3211	5	2906	2	
Galveston	46	1360775	4579	1376579	4380	1638	3	1610	1	106	1320945	4444	1266626	4030	1872	3	1694	1	
Hardin	3	103225	347	104424	332	124	0	122	0	0	0	0	0	0	0	0	0	0	
Harris	630	18575512	62500	18791251	59792	22365	34	21981	14	1642	20405764	68658	19566648	62259	28914	45	26172	16	
Jefferson	44	1299518	4372	1314611	4183	1565	2	1538	1	245	3047832	10255	2922501	9299	4319	7	3909	2	
Liberty	3	102494	345	103684	330	123	0	121	0	6	69309	233	66459	211	98	0	89	0	
Montgomery	109	3211241	10805	3248537	10336	3866	6	3800	2	195	2428968	8173	2329085	7411	3442	5	3115	2	
Orange	5	137617	463	139215	443	166	0	163	0	19	238514	803	228706	728	338	1	306	0	
Tarrant	445	13117620	44136	13269970	42224	15794	24	15522	10	1003	12461094	41927	11948675	38019	17657	27	15983	10	
Waller	0	3921	13	3967	13	5	0	5	0	0	0	0	0	0	0	0	0	0	
Total (Non-attainment)	2372	69984419	235472	70797230	225269	84261	130	82814	51	5490	68228538	229564	65422879	208168	96678	149	87510	54	

Affected Counties	Food									Lodging								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Bastrop	4	127339	428	128817	410	153	0	151	0	45	559083	1881	536093	1706	792	1	717	0
Bexar	305	8983345	30226	9087679	28916	10816	17	10630	7	1202	14935661	50253	14321484	45569	21163	33	19156	12
Caldwell	3	95275	321	96382	307	115	0	113	0	6	69142	233	66299	211	98	0	89	0
Comal	19	559316	1882	565812	1800	673	1	662	0	47	581977	1958	558045	1776	825	1	746	0
Ellis	17	493987	1662	499724	1590	595	1	585	0	21	266351	896	255398	813	377	1	342	0
Gregg	12	352669	1187	356765	1135	425	1	417	0	80	998050	3358	957008	3045	1414	2	1280	1
Guadalupe	18	544301	1831	550622	1752	655	1	644	0	38	468384	1576	449123	1429	664	1	601	0
Harrison	9	252637	850	255571	813	304	0	299	0	33	409496	1378	392657	1249	580	1	525	0
Hays	32	950392	3198	961430	3059	1144	2	1125	1	59	733196	2467	703046	2237	1039	2	940	1
Henderson	2	70072	236	70885	226	84	0	83	0	2	27774	93	26632	85	39	0	36	0
Hood	3	97853	329	98990	315	118	0	116	0	6	77791	262	74592	237	110	0	100	0
Hunt	4	109897	370	111174	354	132	0	130	0	13	161474	543	154834	493	229	0	207	0
Johnson	14	402313	1354	406985	1295	484	1	476	0	4	53496	180	51296	163	76	0	69	0
Kaufman	8	224310	755	226916	722	270	0	265	0	5	66900	225	64149	204	95	0	86	0
Nueces	19	550791	1853	557188	1773	663	1	652	0	162	2010800	6766	1928113	6135	2849	4	2579	2
Parker	19	555344	1869	561794	1788	669	1	657	0	37	462291	1555	443281	1410	655	1	593	0
Rockwall	25	750692	2526	759410	2416	904	1	888	1	15	190484	641	182651	581	270	0	244	0
Rusk	3	84203	283	85181	271	101	0	100	0	1	11089	37	10633	34	16	0	14	0
San Patricio	6	179660	604	181746	578	216	0	213	0	19	239932	807	230066	732	340	1	308	0
Smith	23	683622	2300	691562	2200	823	1	809	0	120	1495844	5033	1434333	4564	2120	3	1919	1
Travis	172	5083271	17103	5142309	16362	6120	9	6015	4	652	8107053	27277	7773679	24735	11487	18	10398	6
Upshur	1	29601	100	29945	95	36	0	35	0	2	25338	85	24296	77	36	0	32	0
Victoria	8	230383	775	233059	742	277	0	273	0	20	245665	827	235562	750	348	1	315	0
Williamson	81	2401364	8080	2429254	7730	2891	4	2842	2	123	1525664	5133	1462927	4655	2162	3	1957	1
Wilson	1	36663	123	37089	118	44	0	43	0	10	118930	400	114040	363	169	0	153	0
Total (Affected)	808	23849300	80244	24126290	76767	28715	44	28221	17	2723	33841865	113865	32450237	103253	47953	74	43406	27

Table 39: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 2)

ERCOT Counties	Food									Lodging								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
ANDERSON	1	16119	54	16306	52	19	0	19	0	2	19734	66	18922	60	28	0	25	0
ANDREWS	0	0	0	0	0	0	0	0	0	3	37237	125	35705	114	53	0	48	0
ANGELINA	12	357245	1202	361394	1150	430	1	423	0	29	360732	1214	345898	1101	511	1	463	0
ARANSAS	7	207800	699	210214	669	250	0	246	0	7	82169	276	78791	251	116	0	105	0
ARCHER	0	0	0	0	0	0	0	0	0	4	50754	171	48667	155	72	0	65	0
ATASCOSA	3	88846	299	89877	286	107	0	105	0	9	109701	369	105190	335	155	0	141	0
AUSTIN	0	6142	21	6214	20	7	0	7	0	5	56664	191	54334	173	80	0	73	0
BANDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	0	0	0	0	0	0	0	0	0	2	27034	91	25923	82	38	0	35	0
BEE	1	43192	145	43694	139	52	0	51	0	21	264203	889	253339	806	374	1	339	0
BELL	23	691912	2328	699948	2227	833	1	819	1	326	4048580	13622	3882097	12352	5737	9	5193	3
Bexar	305	8983345	30226	9087679	28916	10816	17	10630	7	1202	14935661	50253	14321484	45569	21163	33	19156	12
BLANCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BORDEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brazoria	63	1867347	6283	1889034	6011	2248	3	2210	1	57	712562	2398	683260	2174	1010	2	914	1
BRAZOS	28	831891	2799	841552	2678	1002	2	984	1	209	2595034	8731	2488322	7918	3677	6	3328	2
BREWSTER	0	0	0	0	0	0	0	0	0	6	70947	239	68029	216	101	0	91	0
BRISCOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	0	3737	13	3780	12	4	0	4	0	0	2026	7	1943	6	3	0	3	0
BROWN	2	60807	205	61513	196	73	0	72	0	12	153260	516	146957	468	217	0	197	0
BURLESON	0	4030	14	4077	13	5	0	5	0	2	30507	103	29252	93	43	0	39	0
BURNET	3	79763	268	80689	257	96	0	94	0	9	113521	382	108853	346	161	0	146	0
Caldw ell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	5	143473	483	145139	462	173	0	170	0	1	13003	44	12469	40	18	0	17	0
CALLAHAN	0	1905	6	1927	6	2	0	2	0	0	0	0	0	0	0	0	0	0
CAMERON	45	1327239	4466	1342654	4272	1598	2	1571	1	215	2670151	8984	2560350	8147	3784	6	3425	2
Chambers	1	40772	137	41246	131	49	0	48	0	0	0	0	0	0	0	0	0	0
CHEROKEE	3	75998	256	76880	245	92	0	90	0	26	327581	1102	314110	999	464	1	420	0
CHILDRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	0	1154	4	1167	4	1	0	1	0	1	8690	29	8333	27	12	0	11	0
Collin	302	8901199	29949	9004579	28652	10717	17	10533	7	487	6048611	20351	5799883	18455	8571	13	7758	5
COLORADO	0	1772	6	1793	6	2	0	2	0	4	46663	157	44744	142	66	0	60	0
Comal	19	559316	1882	565812	1800	673	1	662	0	47	581977	1958	558045	1776	825	1	746	0
COMANCHE	0	8353	28	8450	27	10	0	10	0	72	892150	3002	855463	2722	1264	2	1144	1
CONCHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	13	394518	1327	399100	1270	475	1	467	0	66	822420	2767	788601	2509	1165	2	1055	1
CORYELL	5	150352	506	152099	484	181	0	178	0	16	204096	687	195704	623	289	0	262	0
COTTLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRANE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROCKETT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROSBY	0	0	0	0	0	0	0	0	0	1	8518	29	8168	26	12	0	11	0
CULBERSON	0	2931	10	2965	9	4	0	3	0	0	0	0	0	0	0	0	0	0
Dallas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DE WITT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Denton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DUVAL	0	6185	21	6257	20	7	0	7	0	0	1173	4	1125	4	2	0	2	0
EASTLAND	5	156016	525	157828	502	188	0	185	0	1	7677	26	7362	23	11	0	10	0
ECTOR	10	300004	1009	303488	966	361	1	355	0	125	1557904	5242	1493840	4753	2208	3	1998	1
EDWARDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ellis	17	493987	1662	499724	1590	595	1	585	0	21	266351	896	255398	813	377	1	342	0
ERATH	1	18974	64	19194	61	23	0	22	0	8	96184	324	92229	293	136	0	123	0
FALLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	1	24235	82	24517	78	29	0	29	0	4	48807	164	46800	149	69	0	63	0
FAYETTE	1	22474	76	22735	72	27	0	27	0	15	187133	630	179438	571	265	0	240	0
FISHER	0	0	0	0	0	0	0	0	0	2	24882	84	23859	76	35	0	32	0
FOARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fort Bend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	0	0	0	0	0	0	0	0	0	0	1958	7	1877	6	3	0	3	0
FREESTONE	0	0	0	0	0	0	0	0	0	1	6291	21	6032	19	9	0	8	0
FRIO	1	29774	100	30120	96	36	0	35	0	2	28674	96	27495	87	41	0	37	0
Galveston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	3	99134	334	100286	319	119	0	117	0	7	85532	288	82015	261	121	0	110	0
GLASSCOCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GONZALES	0	6963	23	7044	22	8	0	8	0	2	19727	66	18915	60	28	0	25	0
GRAYSON	12	341675	1150	345643	1100	411	1	404	0	35	430137	1447	412449	1312	609	1	552	0
GRIMES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guadalupe	18	544301	1831	550622	1752	655	1	644	0	38	468384	1576	449123	1429	664	1	601	0
HALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON	0	0	0	0	0	0	0	0	0	4	44384	149	42559	135	63	0	57	0
HARDEMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	630	18575512	62500	18791251	59792	22365	34	21981	14	1642	20405764	68658	19566648	62259	28914	45	26172	16
HASKELL	2	67770	228	68557	218	82	0	80	0	0	0	0	0	0	0	0	0	0
Hays	32	950392	3198	961430	3059	1144	2	1125	1	59	733196	2467	703046	2237	1039	2	940	1
Henderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	2	54783	184	55419	176	66	0	65	0	3	36489	123	34989	111	52	0	47	0
Hood	3	97853	329	98990	315	118	0	116	0	6	77791	262	74592	237	110	0	100	0
HOPKINS	3	80285	270	81217	258	97	0	95	0	5	67957	229	65162	207	96	0	87	0
HOUSTON	5	136354	459	137938	439	164	0	161	0	7	86474	291	82918	264	123	0	111	0
HOWARD	0	8633	29	8734	28	10	0	10	0	5	65986	222	63273	201	94	0	85	0
HUDSPETH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunt	4	109897	370	111174	354	132	0	130	0	13	161474	543	154834	493	229	0	207	0
IRION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACKSON	0	4540	15	4593	15	5	0	5	0	0	0	0	0	0	0	0	0	0
JEFF DAVIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JIM HOGG	0	0	0	0	0	0	0	0	0	1	11310	38	10845	35	16	0	15	0

Table 40: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Food and Lodging Building Types (USDOE 2004) (Part 3)

ERCOT Counties	Food									Lodging								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
JIM WELLS	6	169675	571	171645	546	204	0	201	0	23	281727	948	270142	860	399	1	361	0
Johnson	14	402313	1354	406985	1295	484	1	476	0	4	53496	180	51296	163	76	0	69	0
JONES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KARNES	0	874	3	884	3	1	0	1	0	1	17449	59	16731	53	25	0	22	0
Kaufman	8	224310	755	226916	722	270	0	265	0	5	66900	225	64149	204	95	0	86	0
KENDALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	0	0	0	0	0	0	0	0	0	2	29856	100	28629	91	42	0	38	0
KERR	6	177723	598	179787	572	214	0	210	0	53	660434	2222	633276	2015	936	1	847	1
KIMBLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	3479	12	3519	11	4	0	4	0	0	0	0	0	0	0	0	0	0
KLEBERG	9	256467	863	259446	826	309	0	303	0	8	101491	341	97318	310	144	0	130	0
KNOX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LA SALLE	0	3151	11	3187	10	4	0	4	0	2	18700	63	17931	57	26	0	24	0
LAMAR	1	39594	133	40054	127	48	0	47	0	2	25902	87	24837	79	37	0	33	0
LAMPASAS	3	92164	310	93234	297	111	0	109	0	7	82702	278	79301	252	117	0	106	0
LAVACA	0	1111	4	1124	4	1	0	1	0	1	9654	32	9257	29	14	0	12	0
LEE	0	7107	24	7190	23	9	0	8	0	0	0	0	0	0	0	0	0	0
LEON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIMESTONE	2	71769	241	72602	231	86	0	85	0	4	43522	146	41732	133	62	0	56	0
LIVE OAK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LLANO	0	0	0	0	0	0	0	0	0	56	698508	2350	669785	2131	990	2	896	1
LOVING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	0	488	2	494	2	1	0	1	0	0	0	0	0	0	0	0	0	0
MARTIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MASON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MATAGORDA	1	36334	122	36756	117	44	0	43	0	9	105652	355	101307	322	150	0	136	0
MAVERICK	3	92055	310	93124	296	111	0	109	0	28	350147	1178	335748	1068	496	1	449	0
MCCULLOCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCLENNAN	26	781531	2630	790608	2516	941	1	925	1	122	1512941	5090	1450727	4616	2144	3	1940	1
MCMULLEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEDINA	0	6663	22	6741	21	8	0	8	0	0	865	3	829	3	1	0	1	0
MENARD	0	0	0	0	0	0	0	0	0	0	2879	10	2761	9	4	0	4	0
MIDLAND	24	699951	2355	708080	2253	843	1	828	1	51	629814	2119	603915	1922	892	1	808	0
MILAM	3	77556	261	78457	250	93	0	92	0	0	0	0	0	0	0	0	0	0
MILLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MITCHELL	0	1649	6	1668	5	2	0	2	0	5	63978	215	61347	195	91	0	82	0
MONTAGUE	3	77080	259	77975	248	93	0	91	0	6	75501	254	72397	230	107	0	97	0
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NACOGDOCHES	5	149317	502	151052	481	180	0	177	0	27	334937	1127	321163	1022	475	1	430	0
NAVARRO	5	139919	471	141544	450	168	0	166	0	14	170536	574	163523	520	242	0	219	0
NOLAN	3	80890	272	81829	260	97	0	96	0	8	98350	331	94306	300	139	0	126	0
Nueces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	4	114185	384	115511	368	137	0	135	0	3	32481	109	31145	99	46	0	42	0
Parker	19	555344	1869	561794	1788	669	1	657	0	37	462291	1555	443281	1410	655	1	593	0
PECOS	0	2676	9	2707	9	3	0	3	0	9	117532	395	112699	359	167	0	151	0
PRESIDIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAINS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REAGAN	0	0	0	0	0	0	0	0	0	0	4443	15	4260	14	6	0	6	0
REAL	0	0	0	0	0	0	0	0	0	4	45267	152	43406	138	64	0	58	0
RED RIVER	0	531	2	537	2	1	0	1	0	0	0	0	0	0	0	0	0	0
REEVES	0	3866	13	3911	12	5	0	5	0	4	50132	169	48071	153	71	0	64	0
REFUGIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROBERTSON	0	0	0	0	0	0	0	0	0	1	17112	58	16408	52	24	0	22	0
Rockwall	25	750692	2526	759410	2416	904	1	888	1	15	190484	641	182651	581	270	0	244	0
RUNNELS	0	6045	20	6115	19	7	0	7	0	0	0	0	0	0	0	0	0	0
Rusk	3	84203	283	85181	271	101	0	100	0	1	11089	37	10633	34	16	0	14	0
San Patricio	6	179660	604	181746	578	216	0	213	0	19	239932	807	230066	732	340	1	308	0
SAN SABA	0	5721	19	5788	18	7	0	7	0	0	0	0	0	0	0	0	0	0
SCHLEICHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	1	31872	107	32242	103	38	0	38	0	2	28790	97	27606	88	41	0	37	0
SHACKELFORD	0	0	0	0	0	0	0	0	0	2	27679	93	26541	84	39	0	36	0
Smith	23	683622	2300	691562	2200	823	1	809	0	120	1495844	5033	1434333	4564	2120	3	1919	1
SOMERVELL	0	1232	4	1246	4	1	0	1	0	1	7419	25	7114	23	11	0	10	0
STARR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	0	0	0	0	0	0	0	0	0	1	14250	48	13664	43	20	0	18	0
STERLING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	0	0	0	0	0	0	0	0	0	1	14097	47	13517	43	20	0	18	0
Tarrant	445	13117620	44136	13269970	42224	15794	24	15522	10	1003	12461094	41927	11948675	38019	17657	27	15983	10
TAYLOR	21	627096	2110	634379	2019	755	1	742	0	60	739461	2488	709053	2256	1048	2	948	1
TERRELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TITUS	2	53523	180	54144	172	64	0	63	0	0	1298	4	1245	4	2	0	2	0
TOM GREEN	14	407352	1371	412083	1311	490	1	482	0	112	1394077	4691	1336751	4253	1975	3	1788	1
Travis	172	5083271	17103	5142309	16362	6120	9	6015	4	652	8107053	27277	7773679	24735	11487	18	10398	6
UPTON	0	0	0	0	0	0	0	0	0	0	1697	6	1627	5	2	0	2	0
UVALDE	9	260179	875	263201	837	313	0	308	0	5	60581	204	58090	185	86	0	78	0
VAL VERDE	2	56015	188	56665	180	67	0	66	0	9	106443	358	102066	325	151	0	137	0
VAN ZANDT	0	1185	4	1199	4	1	0	1	0	0	2574	9	2468	8	4	0	3	0
Victoria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	0	3921	13	3967	13	5	0	5	0	0	0	0	0	0	0	0	0	0
WARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	9	261897	881	264939	843	315	0	310	0	12	143166	482	137278	437	203	0	184	0
WEBB	14	420542	1415	425426	1354	506	1	498	0	95	1183021	3980	1134374	3609	1676	3	1517	1
WHARTON	8	232770	783	235473	749	280	0	275	0	6	79399	267	76134	242	113	0	102	0
WICHITA	13	397852	1339	402473	1281	479	1	471	0	165	2054694	6913	1970202	6269	2911	4	2635	2
WILBARGER	2	67874	228	68663	218	82	0	80	0	11	137552	463	131896	420	195	0	176	0
WILLACY	7	208966	703	211392	673	252	0	247	0	1	15831	53	15180	48	22	0	20	0
Williamson	81	2401364	8080	2429254	7730	2891	4	2842	2	123	1525664	5133	1462927	4655	2162	3	1957	1
Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WISE	0	7611	26	7700	24	9	0	9	0	47	586882	1975	562748	1791	832	1	753	0
YOUNG	6	177424	597	179485	571	214	0	210	0	6	77078	259	73908	235	109	0	99	0
ZAPATA	0	6185	21	6257	20	7	0	7	0	1	17192	58	16485	52	24	0	22	0
ZAVALA	0	0	0	0	0	0	0	0	0	1	14859	50	14248	45	21	0	19	0
Total	2603	76786364	258358	77678174	247163	92451	142	90863	56	7815	97120225	326774	93126496	296318	137617	212	124566	77

Table 41: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 1)

Non-attainment Counties	Office									Warehouse								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Brazoria	70	1006377	3386	899582	2862	390	1	439	0	115	349290	1175	599788	1908	945	1	1051	1
Chambers	13	187704	632	167785	534	73	0	82	0	0	0	0	0	0	0	0	0	0
Collin	683	9882059	33249	8833392	28107	3830	6	4315	3	490	1482606	4988	2545874	8101	4009	6	4460	3
Dallas	2020	29244380	98397	26141015	83178	11334	17	12769	8	2910	8813374	29654	15133992	48155	23834	37	26511	16
Denton	315	4553131	15320	4069960	12950	1765	3	1988	1	758	2294228	7719	3939561	12535	6204	10	6901	4
El Paso	461	6675507	22461	5967113	18987	2587	4	2915	2	1116	3378773	11368	5801901	18461	9137	14	10163	6
Fort Bend	347	5018629	16886	4486060	14274	1945	3	2191	1	484	1464384	4927	2514585	8001	3960	6	4405	3
Galveston	174	2512353	8453	2245746	7146	974	1	1097	1	62	187161	630	321387	1023	506	1	563	0
Hardin	1	19015	64	16997	54	7	0	8	0	0	0	0	0	0	0	0	0	0
Harris	2392	34622642	116492	30948544	98475	13419	21	15117	9	4792	14512762	48830	24920764	79295	39246	60	43655	27
Jefferson	102	1482297	4987	1324998	4216	574	1	647	0	48	144376	486	247917	789	390	1	434	0
Liberty	15	223620	752	199890	636	87	0	98	0	2	7119	24	12224	39	19	0	21	0
Montgomery	321	4641833	15618	4149249	13202	1799	3	2027	1	204	619201	2083	1063268	3383	1674	3	1863	1
Orange	18	258081	868	230694	734	100	0	113	0	15	44942	151	77172	246	122	0	135	0
Tarrant	902	13052258	43916	11667174	37124	5059	8	5699	4	1875	5679685	19110	9752939	31033	15359	24	17085	11
Waller	0	5860	20	5238	17	2	0	3	0	14	41200	139	70747	225	111	0	124	0
Total (Non-attainment)	7833	113385746	381501	101353437	322495	43944	68	49506	31	12884	39019101	131285	67002119	213193	105517	162	117370	72

Affected Counties	Office									Warehouse								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
Bastrop	6	86529	291	77347	246	34	0	38	0	6	18800	63	32283	103	51	0	57	0
Bexar	886	12820683	43137	11460173	36465	4969	8	5598	3	904	2737440	9210	4700628	14957	7403	11	8234	5
Caldwell	2	22441	76	20059	64	9	0	10	0	11	33795	114	58032	185	91	0	102	0
Comal	52	746267	2511	667074	2123	289	0	326	0	28	83568	281	143500	457	226	0	251	0
Ellis	26	369490	1243	330281	1051	143	0	161	0	300	907390	3053	1558136	4958	2454	4	2729	2
Gregg	25	367624	1237	328613	1046	142	0	161	0	42	128635	433	220886	703	348	1	387	0
Guadalupe	66	949774	3196	848985	2701	368	1	415	0	142	430184	1447	738696	2350	1163	2	1294	1
Harrison	13	183113	616	163682	521	71	0	80	0	10	30150	101	51773	165	82	0	91	0
Hays	137	1978598	6657	1768632	5628	767	1	864	1	65	195820	659	336254	1070	530	1	589	0
Henderson	3	39054	131	34910	111	15	0	17	0	17	52343	176	89881	286	142	0	157	0
Hood	10	151613	510	135524	431	59	0	66	0	0	0	0	0	0	0	0	0	0
Hunt	18	253675	854	226756	722	98	0	111	0	11	31929	107	54827	174	86	0	96	0
Johnson	8	116939	393	104529	333	45	0	51	0	64	193180	650	331721	1055	522	1	581	0
Kaufman	15	211365	711	188936	601	82	0	92	0	79	238489	802	409524	1303	645	1	717	0
Nueces	121	1758539	5917	1571925	5002	682	1	768	0	124	374541	1260	643147	2046	1013	2	1127	1
Parker	8	119804	403	107091	341	46	0	52	0	6	19203	65	32975	105	52	0	58	0
Rockwall	26	376948	1268	336947	1072	146	0	165	0	36	110448	372	189658	603	299	0	332	0
Rusk	2	34329	116	30686	98	13	0	15	0	2	7269	24	12482	40	20	0	22	0
San Patricio	75	1086356	3655	971074	3090	421	1	474	0	241	729781	2455	1253152	3987	1974	3	2195	1
Smith	121	1755115	5905	1568865	4992	680	1	766	0	147	444233	1495	762820	2427	1201	2	1336	1
Travis	527	7627861	25665	6818405	21695	2956	5	3330	2	398	1205668	4057	2070327	6588	3260	5	3627	2
Upshur	5	72923	245	65184	207	28	0	32	0	2	5713	19	9809	31	15	0	17	0
Victoria	17	248022	835	221702	705	96	0	108	0	10	29570	99	50777	162	80	0	89	0
Williamson	134	1944494	6543	1738147	5531	754	1	849	1	119	359954	1211	618099	1967	973	1	1083	1
Wilson	0	4033	14	3605	11	2	0	2	0	0	0	0	0	0	0	0	0	0
Total (Affected)	2302	33325590	112128	29789133	94786	12916	20	14550	9	2763	8368102	28156	14369388	45722	22629	35	25171	16

Table 42: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 2)

ERCOT Counties	Office									Warehouse								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
ANDERSON	2	22984	77	20545	65	9	0	10	0	1	3419	12	5871	19	9	0	10	0
ANDREWS	3	43370	146	38768	123	17	0	19	0	0	0	0	0	0	0	0	0	0
ANGELINA	29	420152	1414	375566	1195	163	0	183	0	7	20386	69	35007	111	55	0	61	0
ARANSAS	7	95704	322	85548	272	37	0	42	0	0	589	2	1012	3	2	0	2	0
ARCHER	4	59114	199	52841	168	23	0	26	0	2	6304	21	10826	34	17	0	19	0
ATASCOSA	9	127771	430	114212	363	50	0	56	0	2	6317	21	10847	35	17	0	19	0
AUSTIN	5	65998	222	58995	188	26	0	29	0	194	588084	1979	1009835	3213	1590	2	1769	1
BANDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	2	31487	106	28146	90	12	0	14	0	0	0	0	0	0	0	0	0	0
BEE	21	307723	1035	275068	875	119	0	134	0	0	664	2	1140	4	2	0	2	0
BELL	326	4715461	15866	4215064	13412	1828	3	2059	1	118	356792	1200	612669	1949	965	1	1073	1
Bexar	1202	17395858	58531	15549838	49478	6742	10	7595	5	904	2737440	9210	4700628	14957	7403	11	8234	5
BLANCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BORDEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brazoria	57	829935	2792	741863	2361	322	0	362	0	115	349290	1175	599788	1908	945	1	1051	1
BRAZOS	209	3022487	10170	2701746	8597	1171	2	1320	1	54	164393	553	282289	898	445	1	494	0
BREWSTER	6	82633	278	73864	235	32	0	36	0	6	16803	57	28854	92	45	0	51	0
BRISCOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	0	2360	8	2109	7	1	0	1	0	0	0	0	0	0	0	0	0	0
BROWN	12	178504	601	159562	508	69	0	78	0	6	18864	63	32392	103	51	0	57	0
BURLESON	2	35532	120	31761	101	14	0	16	0	0	0	0	0	0	0	0	0	0
BURNET	9	132220	445	118189	376	51	0	58	0	2	7333	25	12592	40	20	0	22	0
Caldw ell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	1	15145	51	13538	43	6	0	7	0	0	574	2	985	3	2	0	2	0
CALLAHAN	0	0	0	0	0	0	0	0	0	1	3790	13	6508	21	10	0	11	0
CAMERON	215	3109977	10464	2779951	8845	1205	2	1358	1	298	903667	3041	1551743	4937	2444	4	2718	2
Chambers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHEROKEE	26	381540	1284	341052	1085	148	0	167	0	34	101948	343	175061	557	276	0	307	0
CHILDRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	1	10122	34	9048	29	4	0	4	0	0	0	0	0	0	0	0	0	0
Collin	487	7044936	23704	6297339	20037	2730	4	3076	2	490	1482606	4988	2545874	8101	4009	6	4460	3
COLORADO	4	54350	183	48582	155	21	0	24	0	0	358	1	615	2	1	0	1	0
Comal	47	677840	2281	605908	1928	263	0	296	0	28	83568	281	143500	457	226	0	251	0
COMANCHE	72	1039104	3496	928836	2955	403	1	454	0	2	4758	16	8171	26	13	0	14	0
CONCHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	66	957889	3223	856239	2724	371	1	418	0	19	58911	198	101160	322	159	0	177	0
CORYELL	16	237715	800	212489	676	92	0	104	0	7	21164	71	36343	116	57	0	64	0
COTTLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRANE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROCKETT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CROSBY	1	9921	33	8869	28	4	0	4	0	0	0	0	0	0	0	0	0	0
CULBERSON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DE WITT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Denton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DUVAL	0	1366	5	1221	4	1	0	1	0	0	0	0	0	0	0	0	0	0
EASTLAND	1	8942	30	7993	25	3	0	4	0	0	0	0	0	0	0	0	0	0
ECTOR	125	1814521	6105	1621967	5161	703	1	792	0	219	661970	2227	1136710	3617	1790	3	1991	1
EDWARDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ellis	21	310224	1044	277304	882	120	0	135	0	300	907390	3053	1558136	4958	2454	4	2729	2
ERATH	8	112028	377	100140	319	43	0	49	0	2	4921	17	8450	27	13	0	15	0
FALLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	4	56847	191	50814	162	22	0	25	0	5	13683	46	23495	75	37	0	41	0
FAYETTE	15	217958	733	194828	620	84	0	95	0	1	1866	6	3204	10	5	0	6	0
FISHER	2	28981	98	25906	82	11	0	13	0	0	0	0	0	0	0	0	0	0
FOARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fort Bend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	0	2280	8	2038	6	1	0	1	0	26	80036	269	137434	437	216	0	241	0
FREESTONE	1	7327	25	6550	21	3	0	3	0	0	53	0	91	0	0	0	0	0
FRIO	2	33397	112	29853	95	13	0	15	0	0	0	0	0	0	0	0	0	0
Galveston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	7	99621	335	89049	283	39	0	43	0	5	15750	53	27046	86	43	0	47	0
GLASSCOCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GONZALES	2	22976	77	20538	65	9	0	10	0	0	0	0	0	0	0	0	0	0
GRAYSON	35	500989	1686	447825	1425	194	0	219	0	90	273066	919	468898	1492	738	1	821	1
GRIMES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guadalupe	38	545536	1836	487644	1552	211	0	238	0	142	430184	1447	738696	2350	1163	2	1294	1
HALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HAMILTON	4	51695	174	46209	147	20	0	23	0	0	0	0	0	0	0	0	0	0
HARDEMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	1642	23766993	79967	21244879	67599	9211	14	10377	6	4792	14512762	48830	24920764	79295	39246	60	43655	27
HASKELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hays	59	853968	2873	763347	2429	331	1	373	0	65	195820	659	336254	1070	530	1	589	0
Henderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	3	42500	143	37990	121	16	0	19	0	0	0	0	0	0	0	0	0	0
Hood	6	90605	305	80990	258	35	0	40	0	0	0	0	0	0	0	0	0	0
HOPKINS	5	79150	266	70751	225	31	0	35	0	12	36340	122	62402	199	98	0	109	0
HOUSTON	7	100718	339	90030	286	39	0	44	0	0	608	2	1044	3	2	0	2	0
HOWARD	5	76855	259	68700	219	30	0	34	0	0	0	0	0	0	0	0	0	0
HUDSPETH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunt	13	188072	633	168114	535	73	0	82	0	11	31929	107	54827	174	86	0	96	0
IRION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACKSON	0	0	0	0	0	0	0	0	0	0	913	3	1568	5	2	0	3	0
JEFF DAVIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JIM HOGG	1	13173	44	11775	37	5	0	6	0	0	0	0	0	0	0	0	0	0

Table 43: Calculated the ASHRAE Standard 90.1-1989 and 1999 Energy Use for Office and Warehouse Building Types (USDOE 2004) (Part 3)

ERCOT Counties	Office									Warehouse								
	In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL				In	Electricity (kWh/yr), PNNL				Gas (mBtu/yr), PNNL			
	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	thousand	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)	1989 (Annual)	1989 (OSD)	1999 (Annual)	1999 (OSD)
JIM WELLS	23	328133	1104	293312	933	127	0	143	0	4	11339	38	19470	62	31	0	34	0
Johnson	4	62308	210	55696	177	24	0	27	0	64	193180	650	331721	1055	522	1	581	0
JONES	0	0	0	0	0	0	0	0	0	4	11506	39	19757	63	31	0	35	0
KARNES	1	20323	68	18166	58	8	0	9	0	0	0	0	0	0	0	0	0	0
Kaufman	5	77920	262	69651	222	30	0	34	0	79	238489	802	409524	1303	645	1	717	0
KENDALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	2	34774	117	31084	99	13	0	15	0	0	0	0	0	0	0	0	0	0
KERR	53	769221	2588	687592	2188	298	0	336	0	0	1162	4	1995	6	3	0	3	0
KIMBLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KLEBERG	8	118209	398	105665	336	46	0	52	0	1	2838	10	4874	16	8	0	9	0
KNOX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LA SALLE	2	21780	73	19469	62	8	0	10	0	0	0	0	0	0	0	0	0	0
LAMAR	2	30169	102	26967	86	12	0	13	0	2	4642	16	7971	25	13	0	14	0
LAMPASAS	7	96325	324	86103	274	37	0	42	0	0	0	0	0	0	0	0	0	0
LAVACA	1	11244	38	10051	32	4	0	5	0	0	0	0	0	0	0	0	0	0
LEE	0	0	0	0	0	0	0	0	0	0	1435	5	2463	8	4	0	4	0
LEON	0	0	0	0	0	0	0	0	0	0	166	1	285	1	0	0	0	0
LIMESTONE	4	50691	171	45311	144	20	0	22	0	0	1485	5	2550	8	4	0	4	0
LIVE OAK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LLANO	56	813566	2737	727232	2314	315	0	355	0	0	98	0	169	1	0	0	0	0
LOVING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	0	0	0	0	0	0	0	0	0	0	221	1	380	1	1	0	1	0
MARTIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MASON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MATAGORDA	9	123055	414	109996	350	48	0	54	0	7	20739	70	35612	113	56	0	62	0
MAVERICK	28	407823	1372	364545	1160	158	0	178	0	1	1627	5	2793	9	4	0	5	0
MCCULLOCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCLENNAN	122	1762152	5929	1575155	5012	683	1	769	0	121	366536	1233	629402	2003	991	2	1103	1
MCMULLEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEDINA	0	1007	3	900	3	0	0	0	0	1	2069	7	3553	11	6	0	6	0
MENARD	0	3353	11	2997	10	1	0	1	0	0	0	0	0	0	0	0	0	0
MIDLAND	51	733557	2468	655713	2086	284	0	320	0	18	54249	183	93154	296	147	0	163	0
MILAM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MILLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MITCHELL	5	74516	251	66609	212	29	0	33	0	0	0	0	0	0	0	0	0	0
MONTAGUE	6	87938	296	78606	250	34	0	38	0	1	2279	8	3914	12	6	0	7	0
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NACOGDOCHES	27	390107	1313	348710	1110	151	0	170	0	13	40661	137	69821	222	110	0	122	0
NAVARRO	14	198626	668	177549	565	77	0	87	0	34	102711	346	176372	561	278	0	309	0
NOLAN	8	114550	385	102394	326	44	0	50	0	0	0	0	0	0	0	0	0	0
Nueces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	3	37831	127	33817	108	15	0	17	0	2	4579	15	7863	25	12	0	14	0
Parker	37	538439	1812	481301	1531	209	0	235	0	6	19203	65	32975	105	52	0	58	0
PECOS	9	136892	461	122365	389	53	0	60	0	0	0	0	0	0	0	0	0	0
PRESIDIO	0	0	0	0	0	0	0	0	0	0	884	3	1517	5	2	0	3	0
RAINS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REAGAN	0	5175	17	4626	15	2	0	2	0	0	0	0	0	0	0	0	0	0
REAL	4	52724	177	47129	150	20	0	23	0	0	1217	4	2090	7	3	0	4	0
RED RIVER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REEVES	4	58390	196	52194	166	23	0	25	0	0	0	0	0	0	0	0	0	0
REFUGIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROBERTSON	1	19931	67	17816	57	8	0	9	0	1	3671	12	6303	20	10	0	11	0
Rockwall	15	221860	746	198317	631	86	0	97	0	36	110448	372	189658	603	299	0	332	0
RUNNELS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rusk	1	12916	43	11545	37	5	0	6	0	2	7269	24	12482	40	20	0	22	0
San Patricio	19	279453	940	249798	795	108	0	122	0	241	729781	2455	1253152	3987	1974	3	2195	1
SAN SABA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCHLEICHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	2	33532	113	29974	95	13	0	15	0	12	35410	119	60805	193	96	0	107	0
SHACKELFORD	2	32238	108	28817	92	12	0	14	0	0	0	0	0	0	0	0	0	0
Smith	120	1742239	5862	1557356	4955	675	1	761	0	147	444233	1495	762820	2427	1201	2	1336	1
SOMERVELL	1	8642	29	7725	25	3	0	4	0	1	2752	9	4725	15	7	0	8	0
STARR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	1	16597	56	14836	47	6	0	7	0	0	0	0	0	0	0	0	0	0
STERLING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	1	16419	55	14676	47	6	0	7	0	0	0	0	0	0	0	0	0	0
Tarrant	1003	14513680	48833	12973512	41280	5625	9	6337	4	1875	5679685	19110	9752939	31033	15359	24	17085	11
TAYLOR	60	861264	2898	769868	2450	334	1	376	0	52	156657	527	269006	856	424	1	471	0
TERRELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TITUS	0	1512	5	1352	4	1	0	1	0	0	0	0	0	0	0	0	0	0
TOM GREEN	112	1623709	5463	1451404	4618	629	1	709	0	33	99397	334	170680	543	269	0	299	0
Travis	652	9442444	31770	8440427	26856	3660	6	4123	3	398	1205668	4057	2070327	6588	3260	5	3627	2
UPTON	0	1976	7	1766	6	1	0	1	0	0	0	0	0	0	0	0	0	0
UVALDE	5	70560	237	63073	201	27	0	31	0	8	23882	80	41009	130	65	0	72	0
VAL VERDE	9	123976	417	110820	353	48	0	54	0	3	9904	33	17006	54	27	0	30	0
VAN ZANDT	0	2998	10	2680	9	1	0	1	0	0	863	3	1481	5	2	0	3	0
Victoria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	0	0	0	0	0	0	0	0	0	14	41200	139	70747	225	111	0	124	0
WARD	0	0	0	0	0	0	0	0	0	0	207	1	355	1	1	0	1	0
WASHINGTON	12	166748	561	149053	474	65	0	73	0	25	75930	255	130384	415	205	0	228	0
WEBB	95	1377888	4636	1231669	3919	534	1	602	0	118	357701	1204	614231	1954	967	1	1076	1
WHARTON	6	92478	311	82664	263	36	0	40	0	11	34233	115	58784	187	93	0	103	0
WICHITA	165	2393143	8052	2139186	6807	927	1	1045	1	28	84529	284	145150	462	229	0	254	0
WILBARGER	11	160210	539	143209	456	62	0	70	0	1	4339	15	7451	24	12	0	13	0
WILLACY	1	18439	62	16482	52	7	0	8	0	7	21743	73	37337	119	59	0	65	0
Williamson	123	1776971	5979	1588402	5054	689	1	776	0	119	359954	1211	618099	1967	973	1	1083	1
Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WISE	47	683553	2300	611015	1944	265	0	298	0	0	169	1	290	1	0	0	1	0
YOUNG	6	89774	302	80248	255	35	0	39	0	2	4742	16	8144	26	13	0	14	0
ZAPATA	1	20023	67	17899	57	8	0	9	0	0	0	0	0	0	0	0	0	0
ZAVALA	1	17307	58	15470	49	7	0	8	0	0	647	2	1111	4	2	0	2	0
Total	7815	113117832	380600	101113954	321733	43841	67	49389	31	11452	34683641	116698	59557432	189505	93793	144	104329	64

Table 44: Calculated the ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 1)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
Non-attainment Counties																		
(square feet in thousands)																		
Brazoria	-159072	159	-431167	435	-620030	289	21688	-39	-29302	-96	-106795	49	250498	106	-1074180	905	1149	-9686
Chambers	-11534	12	-39471	40	-13538	6	474	-1	0	0	-19919	9	0	0	-83988	66	90	-707
Collin	-779172	781	-1148359	1159	-2955535	1380	103380	-184	-248728	-813	-1048668	485	1063269	450	-5013813	3258	5365	-34864
Dallas	-1541753	1546	-2084932	2105	-3352845	1565	117277	-209	-441975	-1444	-3103366	1434	6320617	2677	-4086976	7674	4373	-82112
Denton	-554879	556	-1227403	1239	-1623117	758	56774	-101	-195535	-639	-483171	223	1645333	697	-2381997	2733	2549	-29245
El Paso	-499679	501	-879666	888	-896698	419	31365	-56	-153214	-501	-708394	327	2423128	1026	-683157	2605	731	-27871
Fort Bend	-357130	358	-643103	649	-1187520	554	41538	-74	-93181	-304	-532569	246	1050201	445	-1721763	1874	1842	-20053
Galveston	-142367	143	-232164	234	-451829	211	15804	-28	-54319	-178	-266607	123	134225	57	-997257	562	1067	-6018
Hardin	-10566	11	-44969	45	-34275	16	1199	-2	0	0	-2018	1	0	0	-90628	71	97	-757
Harris	-2414134	2420	-3477000	3510	-6167773	2879	215739	-384	-839116	-2742	-3674098	1698	10408002	4409	-5948379	11790	6365	-126152
Jefferson	-149550	150	-138418	140	-431489	201	15093	-27	-125331	-410	-157299	73	103541	44	-883454	171	945	-1832
Liberty	-7960	8	-201024	203	-34032	16	1190	-2	-2850	-9	-23730	11	5105	2	-263301	228	282	-2445
Montgomery	-298164	299	-561836	567	-1066253	498	37296	-66	-99883	-326	-492584	228	444067	188	-2037356	1387	2180	-14839
Orange	-18806	19	-125590	127	-45694	21	1598	-3	-9808	-32	-27387	13	32231	14	-193455	158	207	-1695
Tarrant	-1249901	1253	-1843420	1861	-4355546	2033	152350	-271	-512419	-1674	-1385084	640	4073254	1725	-5120766	5567	5479	-59567
Waller	-5302	5	-13845	14	-1302	1	46	0	0	0	-622	0	29547	13	8522	33	-9	-349
Total (Non-attainment)	-8199970	8220	-13092365	13216	-23237474	10848	812811	-1447	-2805660	-9168	-12032309	5562	27983018	11853	-30571949	39083	32712	-418192

Affected Counties																		
(square feet in thousands)																		
Bastrop	-9255	9	-62341	63	-42281	20	1479	-3	-22990	-75	-9182	4	13483	6	-131088	24	140	-258
Bexar	-902452	905	-2099430	2119	-2982810	1392	104334	-186	-614177	-2007	-1360510	629	1963188	832	-5891857	3684	6304	-39419
Caldwell	-3545	4	-70206	71	-31635	15	1107	-2	-2843	-9	-2381	1	24237	10	-85267	89	91	-955
Comal	-42152	42	-170367	172	-185714	87	6496	-12	-23932	-78	-79193	37	59932	25	-434929	273	465	-2923
Ellis	-77707	78	-137676	139	-164022	77	5737	-10	-10953	-36	-39210	18	650746	276	226915	541	-243	-5791
Gregg	-81509	82	-39467	40	-117099	55	4096	-7	-41041	-134	-39012	18	92252	39	-221781	92	237	-984
Guadalupe	-35372	35	-165551	167	-180728	84	6322	-11	-19261	-63	-100788	47	308512	131	-186868	390	200	-4173
Harrison	-66887	67	-71992	73	-83885	39	2934	-5	-16839	-55	-19432	9	21623	9	-234478	137	251	-1463
Hays	-126555	127	-257771	260	-315566	147	11038	-20	-30150	-99	-209966	97	140435	59	-788535	573	844	-6128
Henderson	-7170	7	-24860	25	-23266	11	814	-1	-1142	-4	-4144	2	37538	16	-22231	56	24	-597
Hood	-57855	58	-72923	74	-32491	15	1136	-2	-3199	-10	-16089	7	0	0	-181420	142	194	-1517
Hunt	-28029	28	-94365	95	-36490	17	1276	-2	-6640	-22	-26920	12	22898	10	-168270	139	180	-1483
Johnson	-15983	16	-157714	159	-133583	62	4673	-8	-2200	-7	-12409	6	138541	59	-178676	286	191	-3065
Kaufman	-33385	33	-139599	141	-74480	35	2605	-5	-2751	-9	-22430	10	171035	72	-99004	278	106	-2978
Nueces	-172121	173	-177329	179	-182884	85	6397	-11	-82687	-270	-186613	86	268606	114	-526631	355	563	-3802
Parker	-16167	16	-153399	155	-184395	86	6450	-11	-19010	-62	-12713	6	13772	6	-365464	195	391	-2089
Rockwall	-44818	45	-185932	188	-249258	116	8719	-16	-7833	-26	-40001	18	79209	34	-439914	360	471	-3851
Rusk	-976	1	-7186	7	-27959	13	978	-2	-456	-1	-3643	2	5213	2	-34030	22	36	-235
San Patricio	-22547	23	-66467	67	-59654	28	2087	-4	-9866	-32	-115282	53	523371	222	251640	357	-269	-3815
Smith	-135104	135	-133779	135	-226989	106	7940	-14	-61511	-201	-186250	86	318587	135	-417106	382	446	-4091
Travis	-533636	535	-618499	624	-1687838	788	59038	-105	-333374	-1089	-809456	374	864659	366	-3059106	1493	3273	-15977
Upshur	-18468	19	-34021	34	-9829	5	344	-1	-1042	-3	-7738	4	4097	2	-66657	59	71	-629
Victoria	-28812	29	-19052	19	-76496	36	2676	-5	-10102	-33	-26320	12	21207	9	-136900	67	146	-719
Williamson	-197427	198	-470404	475	-797344	372	27890	-50	-62738	-205	-206346	95	258145	109	-1448224	995	1550	-10647
Wilson	-3802	4	-28244	29	-12173	6	426	-1	-4891	-16	-428	0	0	0	-49113	21	53	-230
Total (Affected)	-2661737	2668	-5458575	5510	-7918870	3697	276990	-493	-1391628	-4548	-3536457	1635	6001285	2542	-14688991	11011	15717	-117819

Table 45: Calculated the ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 2)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
ANDERSON	-2150	2	-1168	1	-5352	2	187	0	-811	-3	-2439	1	2452	1	-9281	5	10	-54
ANDREWS	-1134	1	-6628	7	0	0	0	0	-1531	-5	-4602	2	0	0	-13896	5	15	-53
ANGELINA	-56580	57	-62498	63	-118619	55	4149	-7	-14834	-48	-44586	21	14620	6	-278347	146	298	-1564
ARANSAS	-6747	7	-1647	2	-68998	32	2413	-4	-3379	-11	-10156	5	422	0	-88091	30	94	-323
ARCHER	-2097	2	-20182	20	0	0	0	0	-2087	-7	-6273	3	4521	2	-26117	20	28	-219
ATASCOSA	-19283	19	-24756	25	-29500	14	1032	-2	-4511	-15	-13559	6	4530	2	-86047	50	92	-532
AUSTIN	-945	1	-44521	45	-2040	1	71	0	-2330	-8	-7004	3	421751	179	364982	221	-391	-2364
BANDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	0	0	-1543	2	0	0	0	0	-1112	-4	-3341	2	0	0	-5996	-1	6	6
BEE	-32314	32	-57622	58	-14341	7	502	-1	-10864	-36	-32655	15	476	0	-146818	76	157	-815
BELL	-131879	132	-303492	306	-229741	107	8036	-14	-166484	-544	-500397	231	255877	108	-1068079	327	1143	-3500
Bexar	-902452	905	-2099430	2119	-2982810	1392	104334	-186	-614177	-2007	-1846020	853	1963188	832	-6377367	3908	6824	-41821
BLANCO	-238	0	-20789	21	0	0	0	0	0	0	0	0	0	0	-21027	21	22	-227
BORDEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	-1586	2	-19018	19	0	0	0	0	0	0	0	0	0	0	-20605	21	22	-222
Brazoria	-159072	159	-431167	435	-620030	289	21688	-39	-29302	-96	-88071	41	250498	106	-1055457	897	1129	-9594
BRAZOS	-253877	255	-345388	349	-276219	129	9662	-17	-106712	-349	-320741	148	117896	50	-1175379	564	1258	-6039
BREWSTER	-7455	7	-12603	13	0	0	0	0	-2917	-10	-8769	4	12051	5	-19694	20	21	-212
BRISCOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	-303	0	0	0	-1241	1	43	0	-83	0	-250	0	0	0	-1834	1	2	-7
BROWN	-9224	9	-17450	18	-20190	9	706	-1	-6302	-21	-18943	9	13528	6	-57875	29	62	-309
BURLESON	-1943	2	-13966	14	-1338	1	47	0	-1254	-4	-3771	2	0	0	-22225	14	24	-152
BURNET	-11477	12	-60184	61	-26484	12	926	-2	-4668	-15	-14031	6	5259	2	-110659	76	118	-818
Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	-76	0	-13049	13	-47638	22	1666	-3	-535	-2	-1607	1	411	0	-60827	32	65	-339
CALLAHAN	-4758	5	-20645	21	-633	0	22	0	0	0	0	0	2718	1	-23296	27	25	-289
CAMERON	-135652	136	-459744	464	-440694	206	15415	-27	-109801	-359	-330026	153	648076	275	-812425	847	869	-9059
Chambers	-11534	12	-39471	40	-13538	6	474	-1	0	0	0	0	0	0	-64070	57	69	-609
CHEROKEE	-62075	62	-65944	67	-25234	12	883	-2	-13471	-44	-40488	19	73113	31	-133216	145	143	-1548
CHILDRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	-634	1	-3901	4	0	0	0	0	0	0	0	0	0	0	-4536	5	5	-49
COKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	-1483	1	-1742	2	-383	0	13	0	-357	-1	-1074	0	0	0	-5026	3	5	-29
Collin	-779172	781	-1148359	1159	-2955535	1380	103380	-184	-248728	-813	-747597	346	1063269	450	-4712742	3119	5043	-33375
COLORADO	0	0	-19980	20	-588	0	21	0	-1919	-6	-5767	3	257	0	-27978	17	30	-181
Comal	-42152	42	-170367	172	-185714	87	6496	-12	-23932	-78	-71931	33	59932	25	-427668	270	458	-2887
COMANCHE	-11824	12	-42845	43	-2773	1	97	0	-36687	-120	-110268	51	3412	1	-200888	-11	215	120
CONCHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	-36458	37	-89747	91	-130995	61	4582	-8	-33819	-111	-101650	47	42249	18	-345838	135	370	-1439
CORYELL	-22121	22	-41084	41	-49923	23	1746	-3	-8393	-27	-25226	12	15178	6	-129822	75	139	-797
COTTLE	0	0	-1796	2	0	0	0	0	0	0	0	0	0	0	-1796	2	2	-19
CRANE	-2542	3	-1713	2	0	0	0	0	0	0	0	0	0	0	-4255	4	5	-46
CROCKETT	-5078	5	-1902	2	0	0	0	0	0	0	0	0	0	0	-6980	7	7	-75
CROSBY	-1211	1	-254	0	0	0	0	0	-350	-1	-1053	0	0	0	-2868	1	3	-9
CULBERSON	-1154	1	-9818	10	-973	0	34	0	0	0	0	0	0	0	-11910	11	13	-123
Dallas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	-675	1	-7924	8	0	0	0	0	0	0	0	0	0	0	-8599	9	9	-93
DE WITT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	-389	0	-3106	3	0	0	0	0	0	0	0	0	0	0	-3496	4	4	-38
Denton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	-3081	3	0	0	0	0	0	0	0	0	0	0	-3081	3	3	-33
DUVAL	-361	0	-24087	24	-2054	1	72	0	-48	0	-145	0	0	0	-26622	25	28	-272
EASTLAND	-12110	12	-4438	4	-51803	24	1812	-3	-316	-1	-949	0	0	0	-67804	37	73	-396
ECTOR	-47117	47	-108901	110	-99613	47	3484	-6	-64063	-209	-192554	89	474740	201	-34024	278	36	-2977
EDWARDS	-260	0	-549	1	0	0	0	0	0	0	0	0	0	0	-809	1	1	-9
Ellis	-77707	78	-137676	139	-164022	77	5737	-10	-10953	-36	-32920	15	650746	276	233205	538	-250	-5760
ERATH	-7131	7	-36508	37	-6300	3	220	0	-3955	-13	-11888	5	3529	1	-62033	41	66	-435
FALLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	-9588	10	-24042	24	-8047	4	281	-1	-2007	-7	-6032	3	9813	4	-39623	38	42	-401
FAYETTE	-3567	4	-16585	17	-7462	3	261	0	-7695	-25	-23129	11	1338	1	-56840	9	61	-101
FISHER	0	0	-4004	4	0	0	0	0	-1023	-3	-3075	1	0	0	-8103	2	9	-23
FOARD	-301	0	0	0	0	0	0	0	0	0	0	0	0	0	-301	0	0	-3
Fort Bend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	-657	1	0	0	0	0	0	0	-81	0	-242	0	57399	24	56419	25	-60	-266

Table 46: Calculated the ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 3)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
FREESTONE	0	0	-9785	10	0	0	0	0	-259	-1	-778	0	38	0	-10783	9	12	-101
FRIO	-847	1	-18332	19	-9886	5	346	-1	-1179	-4	-3544	2	0	0	-33443	21	36	-226
Galveston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	-12786	13	-6501	7	-32916	15	1151	-2	-3517	-11	-10572	5	11295	5	-53846	31	58	-330
GLASSCOCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	-5151	5	0	0	0	0	0	0	0	0	0	0	-5151	5	6	-56
GONZALES	-836	1	-4629	5	-2312	1	81	0	-811	-3	-2438	1	0	0	-10946	5	12	-53
GRAYSON	-43152	43	-132934	134	-113449	53	3968	-7	-17688	-58	-53164	25	195832	83	-160586	273	172	-2922
GRIMES	-5044	5	-8986	9	0	0	0	0	0	0	0	0	0	0	-14029	14	15	-151
Guadalupe	-35372	35	-165551	167	-180728	84	6322	-11	-19261	-63	-57891	27	308512	131	-143971	370	154	-3961
HALL	0	0	-634	1	0	0	0	0	0	0	0	0	0	0	-634	1	1	-7
HAMILTON	-577	1	-6883	7	0	0	0	0	-1825	-6	-5486	3	0	0	-14771	4	16	-44
HARDEMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	-2414134	2420	-3477000	3510	-6167773	2879	215739	-384	-839116	-2742	-2522114	1166	10408002	4409	-4796395	11257	5132	-120455
HASKELL	-288	0	0	0	-22502	11	787	-1	0	0	0	0	0	0	-22004	9	24	-101
Hays	-126555	127	-257771	260	-315566	147	11038	-20	-30150	-99	-90622	42	140435	59	-669191	518	716	-5538
Henderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	-7095	7	-58053	59	-18190	8	636	-1	-1500	-5	-4510	2	0	0	-88712	70	95	-752
Hood	-57855	58	-72923	74	-32491	15	1136	-2	-3199	-10	-9615	4	0	0	-174946	139	187	-1485
HOPKINS	-8527	9	-19577	20	-26658	12	932	-2	-2794	-9	-8399	4	26062	11	-38961	45	42	-480
HOUSTON	-3125	3	-6431	6	-45275	21	1584	-3	-3556	-12	-10688	5	436	0	-67055	21	72	-229
HOWARD	-7098	7	-11906	12	-2867	1	100	0	-2713	-9	-8156	4	0	0	-32640	15	35	-163
HUDSPETH	-1103	1	-10233	10	0	0	0	0	0	0	0	0	0	0	-11336	11	12	-122
Hunt	-28029	28	-94365	95	-36490	17	1276	-2	-6640	-22	-19958	9	22898	10	-161308	135	173	-1448
IRION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	-2163	2	-1120	1	0	0	0	0	0	0	0	0	0	0	-3283	3	4	-35
JACKSON	-2296	2	-18895	19	-1508	1	53	0	0	0	0	0	655	0	-21991	22	24	-238
JEFF DAVIS	-10753	11	-169	0	0	0	0	0	0	0	0	0	0	0	-10922	11	12	-117
JIM HOGG	-726	1	-9743	10	0	0	0	0	-465	-2	-1398	1	0	0	-12333	10	13	-104
JIM WELLS	-363	0	-55768	56	-56338	26	1971	-4	-11585	-38	-34821	16	8132	3	-148773	61	159	-654
Johnson	-15983	16	-157714	159	-133583	62	4673	-8	-2200	-7	-6612	3	138541	59	-172878	284	185	-3037
JONES	-13723	14	-9954	10	0	0	0	0	0	0	0	0	8251	3	-15426	27	17	-292
KARNES	0	0	-7903	8	-290	0	10	0	-718	-2	-2157	1	0	0	-11058	7	12	-72
Kaufman	-33385	33	-139599	141	-74480	35	2605	-5	-2751	-9	-8269	4	171035	72	-84843	272	91	-2908
KENDALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	0	0	0	0	0	0	0	0	-1228	-4	-3690	2	0	0	-4918	-2	5	25
KERR	-72102	72	-58423	59	-59011	28	2064	-4	-27158	-89	-81628	38	833	0	-295425	104	316	-1118
KIMBLE	-2740	3	-317	0	0	0	0	0	0	0	0	0	0	0	-3057	3	3	-33
KING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	0	-3625	4	-1155	1	40	0	0	0	0	0	0	0	-4740	4	5	-44
KLEBERG	-9945	10	-44859	45	-85157	40	2979	-5	-4173	-14	-12544	6	2036	1	-151664	83	162	-885
KNOX	-1442	1	-1479	1	0	0	0	0	0	0	0	0	0	0	-2921	3	3	-31
LA SALLE	0	0	-1465	1	-1046	0	37	0	-769	-3	-2311	1	0	0	-5555	0	6	-5
LAMAR	-6829	7	-33650	34	-13147	6	460	-1	-1065	-3	-3201	1	3329	1	-54103	46	58	-487
LAMPASAS	-3012	3	-11001	11	-30602	14	1070	-2	-3401	-11	-10222	5	0	0	-57167	20	61	-215
LAVACA	-11927	12	-2412	2	-369	0	13	0	-397	-1	-1193	1	0	0	-16285	14	17	-148
LEE	-1175	1	-15543	16	-2360	1	83	0	0	0	0	0	1029	0	-17966	18	19	-195
LEON	-11639	12	-7876	8	0	0	0	0	0	0	0	0	119	0	-19395	20	21	-210
LIMESTONE	-4826	5	-6229	6	-23830	11	834	-1	-1790	-6	-5379	2	1065	0	-40155	18	43	-191
LIVE OAK	-17650	18	0	0	0	0	0	0	0	0	0	0	0	0	-17650	18	19	-189
LLANO	-1000	1	-28529	29	0	0	0	0	-28724	-94	-86334	40	71	0	-144516	-24	155	258
LOVING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	-934	1	-11636	12	-162	0	6	0	0	0	0	0	159	0	-12568	13	13	-137
MARTIN	0	0	-528	1	0	0	0	0	0	0	0	0	0	0	-528	1	1	-6
MASON	0	0	-1310	1	0	0	0	0	0	0	0	0	0	0	-1310	1	1	-14
MATAGORDA	-6290	6	-30532	31	-12064	6	422	-1	-4345	-14	-13058	6	14873	6	-50994	40	55	-430
MAVERICK	-21333	21	-47927	48	-30566	14	1069	-2	-14399	-47	-43277	20	1167	0	-155266	56	166	-595
MCCULLOCH	-681	1	-11198	11	0	0	0	0	0	0	0	0	0	0	-11879	12	13	-128
MCLENNAN	-119979	120	-313073	316	-259498	121	9077	-16	-62214	-203	-186997	86	262866	111	-669819	536	717	-5733
MCMULLEN	-3702	4	-740	1	0	0	0	0	0	0	0	0	0	0	-4442	4	5	-48
MEDINA	-5595	6	-23686	24	-2212	1	77	0	-36	0	-107	0	1484	1	-30074	31	32	-331
MENARD	-575	1	-1396	1	0	0	0	0	-118	0	-356	0	0	0	-2445	2	3	-19
MIDLAND	-149008	149	-69213	70	-232410	108	8129	-14	-25899	-85	-77844	36	38905	16	-507339	281	543	-3008
MILAM	-4614	5	-45724	46	-25752	12	901	-2	0	0	0	0	0	0	-75189	61	80	-655
MILLS	-2780	3	-9441	10	0	0	0	0	0	0	0	0	0	0	-12222	12	13	-132
MITCHELL	-6124	6	-180	0	-547	0	19	0	-2631	-9	-7908	4	0	0	-17371	2	19	-17
MONTAGUE	-2135	2	-14881	15	-25593	12	895	-2	-3105	-10	-9332	4	1634	1	-52516	22	56	-239
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	-750	1	0	0	0	0	0	0	0	0	0	0	-750	1	1	-8

Table 47: Calculated the ASHRAE Standard 90.1-1989 and 1999 Annual Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 4)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
NACOGDOCHES	-36751	37	-138086	139	-49579	23	1734	-3	-13773	-45	-41398	19	29160	12	-248692	183	266	-1956
NAVARRO	-5335	5	-35189	36	-46458	22	1625	-3	-7013	-23	-21078	10	73661	31	-39787	78	43	-831
NOLAN	-9440	9	-20285	20	-26859	13	939	-2	-4044	-13	-12156	6	0	0	-71844	33	77	-355
Nueces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	-7290	7	-30483	31	-37914	18	1326	-2	-1336	-4	-4015	2	3284	1	-76427	52	82	-560
Parker	-16167	16	-153399	155	-184395	86	6450	-11	-19010	-62	-57138	26	13772	6	-409888	216	439	-2309
PECOS	-5468	5	-7271	7	-889	0	31	0	-4833	-16	-14527	7	0	0	-32956	4	35	-44
PRESIDIO	-4357	4	-5689	6	0	0	0	0	0	0	0	0	634	0	-9412	10	10	-111
RAINS	-1033	1	-9497	10	0	0	0	0	0	0	0	0	0	0	-10530	11	11	-114
REAGAN	-2403	2	0	0	0	0	0	0	-183	-1	-549	0	0	0	-3135	2	3	-22
REAL	-764	1	-676	1	0	0	0	0	-1861	-6	-5595	3	873	0	-8024	-2	9	18
RED RIVER	-2773	3	-16155	16	-176	0	6	0	0	0	0	0	0	0	-19098	19	20	-205
REEVES	-8283	8	-2272	2	-1284	1	45	0	-2062	-7	-6196	3	0	0	-20051	7	21	-78
REFUGIO	-1847	2	-900	1	0	0	0	0	0	0	0	0	0	0	-2747	3	3	-30
ROBERTSON	-2221	2	-3632	4	0	0	0	0	-704	-2	-2115	1	2632	1	-6038	6	6	-61
Rockwall	-44818	45	-185932	188	-249258	116	8719	-16	-7833	-26	-23543	11	79209	34	-423457	352	453	-3769
RUNNELS	0	0	-7100	7	-2007	1	70	0	0	0	0	0	0	0	-9037	8	10	-85
Rusk	-976	1	-7186	7	-27959	13	978	-2	-456	-1	-1371	1	5213	2	-31757	21	34	-224
San Patricio	-22547	23	-66467	67	-59654	28	2087	-4	-9866	-32	-29655	14	523371	222	337268	317	-361	-3392
SAN SABA	-7238	7	-3170	3	-1900	1	66	0	0	0	0	0	0	0	-12241	11	13	-120
SCHLEICHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	-915	1	-296	0	-10583	5	370	-1	-1184	-4	-3558	2	25395	11	9229	14	-10	-150
SHACKELFORD	-3043	3	-4607	5	0	0	0	0	-1138	-4	-3421	2	0	0	-12208	6	13	-60
Smith	-135104	135	-133779	135	-226989	106	7940	-14	-61511	-201	-184884	85	318587	135	-415740	382	445	-4084
SOMERVELL	-428	0	-7935	8	-409	0	14	0	-305	-1	-917	0	1974	1	-8007	9	9	-95
STARR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	0	0	-7057	7	0	0	0	0	-586	-2	-1761	1	0	0	-9404	6	10	-64
STERLING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	0	0	-1955	2	0	0	0	0	-580	-2	-1742	1	0	0	-4277	1	5	-9
Tarrant	-1249901	1253	-1843420	1861	-4355546	2033	152350	-271	-512419	-1674	-1540168	712	4073254	1725	-5275849	5639	5645	-60334
TAYLOR	-57246	57	-57969	59	-208220	97	7283	-13	-30408	-99	-91396	42	112349	48	-325606	191	348	-2040
TERRELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	-1730	2	0	0	0	0	0	0	0	0	0	0	0	0	-1730	2	2	-19
TITUS	-7356	7	-30341	31	-17772	8	622	-1	-53	0	-160	0	0	0	-55060	45	59	-482
TOM GREEN	-103324	104	-104472	105	-135256	63	4731	-8	-57327	-187	-172305	80	71284	30	-496670	186	531	-1993
Travis	-533636	535	-618499	624	-1687838	788	59038	-105	-333374	-1089	-1002017	463	864659	366	-3251666	1582	3479	-16929
UPTON	0	0	0	0	0	0	0	0	-70	0	-210	0	0	0	-279	0	0	1
UVALDE	-23502	24	-38309	39	-86389	40	3022	-5	-2491	-8	-7488	3	17127	7	-138030	100	148	-1067
VAL VERDE	-14958	15	-34349	35	-18599	9	651	-1	-4377	-14	-13156	6	7102	3	-77686	52	83	-556
VAN ZANDT	-2449	2	-47976	48	-393	0	14	0	-106	0	-318	0	619	0	-50611	51	54	-547
Victoria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	-5302	5	-13845	14	-1302	1	46	0	0	0	0	0	29547	13	9143	32	-10	-346
WARD	0	0	0	0	0	0	0	0	0	0	0	0	148	0	148	0	0	-1
WASHINGTON	-51085	51	-42348	43	-86960	41	3042	-5	-5887	-19	-17695	8	54454	23	-146479	141	157	-1510
WEBB	-47062	47	-324000	327	-139636	65	4884	-9	-48648	-159	-146219	68	256530	109	-444151	448	475	-4794
WHARTON	-15549	16	-18741	19	-77288	36	2703	-5	-3265	-11	-9814	5	24551	10	-97403	70	104	-749
WICHITA	-100171	100	-59081	60	-132102	62	4621	-8	-84492	-276	-253956	117	60621	26	-564561	80	604	-861
WILBARGER	-5209	5	-8104	8	-22537	11	788	-1	-5656	-18	-17001	8	3112	1	-54607	13	58	-141
WILLACY	-3192	3	-49448	50	-69384	32	2427	-4	-651	-2	-1957	1	15593	7	-106611	87	114	-926
Williamson	-197427	198	-470404	475	-797344	372	27890	-50	-62738	-205	-188569	87	258145	109	-1430447	987	1531	-10559
Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	-1480	1	-268	0	0	0	0	0	0	0	0	0	0	0	-1748	2	2	-19
WISE	-30957	31	-85603	86	-2527	1	88	0	-24133	-79	-72537	34	121	0	-215549	73	231	-783
YOUNG	-16710	17	-24385	25	-58912	28	2061	-4	-3170	-10	-9527	4	3401	1	-107241	61	115	-649
ZAPATA	-3749	4	-47523	48	-2054	1	72	0	-707	-2	-2125	1	0	0	-56086	51	60	-548
ZAVALA	-209	0	-5382	5	0	0	0	0	-611	-2	-1837	1	464	0	-7575	5	8	-50
Total	-8969811	8992	-16386931	16541	-25495977	11902	891810	-1588	-3993729	-13051	-12003878	5548	24873791	10536	-41084725	38882	43961	-416037

Table 48: Calculated the ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 1)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
Non-attainment Counties																		
(square feet in thousands)																		
Brazoria	-813	-3	-2064	-6	-2692	-1	-272	-2	-223	-1	-524	0	733	-1	-5855	-14	6	146
Chambers	-59	0	-189	-1	-59	0	-6	0	0	0	-98	0	0	0	-410	-1	0	9
Collin	-3980	-13	-5497	-16	-12833	-3	-1298	-10	-1897	-8	-5143	-3	3112	-3	-27535	-58	29	617
Dallas	-7875	-26	-9980	-29	-14558	-4	-1472	-11	-3370	-15	-15219	-10	18501	-20	-33974	-115	36	1234
Denton	-2834	-9	-5875	-17	-7048	-2	-713	-5	-1491	-7	-2369	-1	4816	-5	-15514	-47	17	507
El Paso	-2552	-8	-4211	-12	-3894	-1	-394	-3	-1168	-5	-3474	-2	7093	-8	-8600	-40	9	428
Fort Bend	-1824	-6	-3078	-9	-5156	-1	-521	-4	-711	-3	-2612	-2	3074	-3	-10828	-29	12	306
Galveston	-727	-2	-1111	-3	-1962	0	-198	-2	-414	-2	-1307	-1	393	0	-5328	-11	6	116
Hardin	-54	0	-215	-1	-149	0	-15	0	0	0	-10	0	0	0	-443	-1	0	10
Harris	-12331	-41	-16643	-49	-26781	-7	-2708	-21	-6399	-28	-18018	-11	30465	-33	-52415	-191	56	2040
Jefferson	-764	-3	-663	-2	-1874	0	-189	-1	-956	-4	-771	0	303	0	-4914	-11	5	123
Liberty	-41	0	-962	-3	-148	0	-15	0	-22	0	-116	0	15	0	-1289	-3	1	35
Montgomery	-1523	-5	-2689	-8	-4630	-1	-468	-4	-762	-3	-2416	-2	1300	-1	-11188	-24	12	258
Orange	-96	0	-601	-2	-198	0	-20	0	-75	0	-134	0	94	0	-1030	-3	1	30
Tarrant	-6384	-21	-8824	-26	-18912	-5	-1912	-15	-3908	-17	-6792	-4	11923	-13	-34810	-101	37	1085
Waller	-27	0	-66	0	-6	0	-1	0	0	0	-3	0	86	0	-16	0	0	4
Total (Non-attainment)	-41885	-138	-62667	-185	-100900	-26	-10203	-79	-21396	-95	-59006	-37	81908	-90	-214148	-649	229	6949

Affected Counties																		
(square feet in thousands)																		
Bastrop	-47	0	-298	-1	-184	0	-19	0	-175	-1	-45	0	39	0	-729	-2	1	22
Bexar	-4610	-15	-10049	-30	-12952	-3	-1310	-10	-4684	-21	-6672	-4	5746	-6	-34529	-90	37	958
Caldwell	-18	0	-336	-1	-137	0	-14	0	-22	0	-12	0	71	0	-468	-1	1	15
Comal	-215	-1	-815	-2	-806	0	-82	-1	-183	-1	-388	0	175	0	-2314	-5	2	56
Ellis	-397	-1	-659	-2	-712	0	-72	-1	-84	0	-192	0	1905	-2	-211	-7	0	70
Gregg	-416	-1	-189	-1	-508	0	-51	0	-313	-1	-191	0	270	0	-1399	-4	1	46
Guadalupe	-181	-1	-792	-2	-785	0	-79	-1	-147	-1	-494	0	903	-1	-1575	-6	2	61
Harrison	-342	-1	-345	-1	-364	0	-37	0	-128	-1	-95	0	63	0	-1248	-3	1	34
Hays	-646	-2	-1234	-4	-1370	0	-139	-1	-230	-1	-1030	-1	411	0	-4238	-9	5	100
Henderson	-37	0	-119	0	-101	0	-10	0	-9	0	-20	0	110	0	-186	-1	0	8
Hood	-296	-1	-349	-1	-141	0	-14	0	-24	0	-79	0	0	0	-903	-2	1	25
Hunt	-143	0	-452	-1	-158	0	-16	0	-51	0	-132	0	67	0	-885	-2	1	25
Johnson	-82	0	-755	-2	-580	0	-59	0	-17	0	-61	0	406	0	-1147	-4	1	39
Kaufman	-171	-1	-668	-2	-323	0	-33	0	-21	0	-110	0	501	-1	-825	-4	1	38
Nueces	-879	-3	-849	-3	-794	0	-80	-1	-631	-3	-915	-1	786	-1	-3362	-10	4	112
Parker	-83	0	-734	-2	-801	0	-81	-1	-145	-1	-62	0	40	0	-1865	-4	2	43
Rockwall	-229	-1	-890	-3	-1082	0	-109	-1	-60	0	-196	0	232	0	-2335	-5	2	55
Rusk	-5	0	-34	0	-121	0	-12	0	-3	0	-18	0	15	0	-179	0	0	3
San Patricio	-115	0	-318	-1	-259	0	-26	0	-75	0	-565	0	1532	-2	173	-4	0	42
Smith	-690	-2	-640	-2	-986	0	-100	-1	-469	-2	-913	-1	933	-1	-2866	-9	3	95
Travis	-2726	-9	-2960	-9	-7329	-2	-741	-6	-2542	-11	-3970	-2	2531	-3	-17737	-42	19	448
Upshur	-94	0	-163	0	-43	0	-4	0	-8	0	-38	0	12	0	-338	-1	0	10
Victoria	-147	0	-91	0	-332	0	-34	0	-77	0	-129	0	62	0	-748	-2	1	17
Williamson	-1008	-3	-2252	-7	-3462	-1	-350	-3	-478	-2	-1012	-1	756	-1	-7807	-17	8	183
Wilson	-19	0	-135	0	-53	0	-5	0	-37	0	-2	0	0	0	-252	-1	0	7
Total (Affected)	-13596	-45	-26128	-77	-34385	-9	-3477	-27	-10612	-47	-17343	-11	17566	-19	-87974	-235	94	2512

Table 49: Calculated the ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 2)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
ANDERSON	-11	0	-6	0	-23	0	-2	0	-6	0	-12	0	7	0	-53	0	0	1
ANDREWS	-6	0	-32	0	0	0	0	0	-12	0	-23	0	0	0	-72	0	0	2
ANGELINA	-289	-1	-299	-1	-515	0	-52	0	-113	-1	-219	0	43	0	-1444	-3	2	33
ARANSAS	-34	0	-8	0	-300	0	-30	0	-26	0	-50	0	1	0	-447	-1	0	6
ARCHER	-11	0	-97	0	0	0	0	0	-16	0	-31	0	13	0	-141	0	0	5
ATASCOSA	-98	0	-118	0	-128	0	-13	0	-34	0	-66	0	13	0	-446	-1	0	11
AUSTIN	-5	0	-213	-1	-9	0	-1	0	-18	0	-34	0	1234	-1	955	-2	-1	23
BANDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bastrop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BAYLOR	0	0	-7	0	0	0	0	0	-8	0	-16	0	0	0	-32	0	0	1
BEE	-165	-1	-276	-1	-62	0	-6	0	-83	0	-160	0	1	0	-751	-2	1	20
BELL	-674	-2	-1453	-4	-998	0	-101	-1	-1270	-6	-2454	-2	749	-1	-6199	-16	7	166
Bexar	-4610	-15	-10049	-30	-12952	-3	-1310	-10	-4684	-21	-9053	-6	5746	-6	-36910	-91	39	974
BLANCO	-1	0	-100	0	0	0	0	0	0	0	0	0	0	0	-101	0	0	3
BORDEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOSQUE	-8	0	-91	0	0	0	0	0	0	0	0	0	0	0	-99	0	0	3
Brazoria	-813	-3	-2064	-6	-2692	-1	-272	-2	-223	-1	-432	0	733	-1	-5763	-14	6	146
BRAZOS	-1297	-4	-1653	-5	-1199	0	-121	-1	-814	-4	-1573	-1	345	0	-6312	-15	7	165
BREWSTER	-38	0	-60	0	0	0	0	0	-22	0	-43	0	35	0	-128	0	0	5
BRISCOE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROOKS	-2	0	0	0	-5	0	-1	0	-1	0	-1	0	0	0	-9	0	0	0
BROWN	-47	0	-84	0	-88	0	-9	0	-48	0	-93	0	40	0	-329	-1	0	9
BURLESON	-10	0	-67	0	-6	0	-1	0	-10	0	-18	0	0	0	-111	0	0	3
BURNET	-59	0	-288	-1	-115	0	-12	0	-36	0	-69	0	15	0	-562	-1	1	15
Caldw ell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALHOUN	0	0	-62	0	-207	0	-21	0	-4	0	-8	0	1	0	-301	0	0	5
CALLAHAN	-24	0	-99	0	-3	0	0	0	0	0	0	0	8	0	-118	0	0	4
CAMERON	-693	-2	-2201	-6	-1914	0	-193	-1	-837	-4	-1618	-1	1897	-2	-5559	-18	6	188
Chambers	-59	0	-189	-1	-59	0	-6	0	0	0	0	0	0	0	-313	-1	0	9
CHEROKEE	-317	-1	-316	-1	-110	0	-11	0	-103	0	-199	0	214	0	-841	-3	1	31
CHILDRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLAY	-3	0	-19	0	0	0	0	0	0	0	0	0	0	0	-22	0	0	1
COKE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLEMAN	-8	0	-8	0	-2	0	0	0	-3	0	-5	0	0	0	-26	0	0	1
Collin	-3980	-13	-5497	-16	-12833	-3	-1298	-10	-1897	-8	-3666	-2	3112	-3	-26058	-57	28	607
COLORADO	0	0	-96	0	-3	0	0	0	-15	0	-28	0	1	0	-141	0	0	4
Comal	-215	-1	-815	-2	-806	0	-82	-1	-183	-1	-353	0	175	0	-2279	-5	2	55
COMANCHE	-60	0	-205	-1	-12	0	-1	0	-280	-1	-541	0	10	0	-1089	-2	1	26
CONCHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COOKE	-186	-1	-430	-1	-569	0	-58	0	-258	-1	-498	0	124	0	-1875	-4	2	43
CORYELL	-113	0	-197	-1	-217	0	-22	0	-64	0	-124	0	44	0	-692	-2	1	17
COTTLE	0	0	-9	0	0	0	0	0	0	0	0	0	0	0	-9	0	0	0
CRANE	-13	0	-8	0	0	0	0	0	0	0	0	0	0	0	-21	0	0	1
CROCKETT	-26	0	-9	0	0	0	0	0	0	0	0	0	0	0	-35	0	0	1
CROSBY	-6	0	-1	0	0	0	0	0	-3	0	-5	0	0	0	-15	0	0	0
CULBERSON	-6	0	-47	0	-4	0	0	0	0	0	0	0	0	0	-58	0	0	2
Dallas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAWSON	-3	0	-38	0	0	0	0	0	0	0	0	0	0	0	-41	0	0	1
DE WITT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DELTA	-2	0	-15	0	0	0	0	0	0	0	0	0	0	0	-17	0	0	1
Denton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DICKENS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIMMIT	0	0	-15	0	0	0	0	0	0	0	0	0	0	0	-15	0	0	0
DUVAL	-2	0	-115	0	-9	0	-1	0	0	0	-1	0	0	0	-128	0	0	4
EASTLAND	-62	0	-21	0	-225	0	-23	0	-2	0	-5	0	0	0	-338	-1	0	5
ECTOR	-241	-1	-521	-2	-433	0	-44	0	-489	-2	-944	-1	1390	-2	-1281	-7	1	76
EDWARDS	-1	0	-3	0	0	0	0	0	0	0	0	0	0	0	-4	0	0	0
Ellis	-397	-1	-659	-2	-712	0	-72	-1	-84	0	-161	0	1905	-2	-180	-7	0	70
ERATH	-36	0	-175	-1	-27	0	-3	0	-30	0	-58	0	10	0	-319	-1	0	9
FALLS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FANNIN	-49	0	-115	0	-35	0	-4	0	-15	0	-30	0	29	0	-219	-1	0	7
FAYETTE	-18	0	-79	0	-32	0	-3	0	-59	0	-113	0	4	0	-301	-1	0	7
FISHER	0	0	-19	0	0	0	0	0	-8	0	-15	0	0	0	-42	0	0	1
FOARD	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0
Fort Bend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRANKLIN	-3	0	0	0	0	0	0	0	-1	0	-1	0	168	0	163	0	0	2

Table 50: Calculated the ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 3)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
FREESTONE	0	0	-47	0	0	0	0	0	-2	0	-4	0	0	0	-53	0	0	2
FRIO	-4	0	-88	0	-43	0	-4	0	-9	0	-17	0	0	0	-166	0	0	4
Galveston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GILLESPIE	-65	0	-31	0	-143	0	-14	0	-27	0	-52	0	33	0	-299	-1	0	7
GLASSCOCK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GOLIAD	0	0	-25	0	0	0	0	0	0	0	0	0	0	0	-25	0	0	1
GONZALES	-4	0	-22	0	-10	0	-1	0	-6	0	-12	0	0	0	-56	0	0	1
GRAYSON	-220	-1	-636	-2	-493	0	-50	0	-135	-1	-261	0	573	-1	-1222	-5	1	48
GRIMES	-26	0	-43	0	0	0	0	0	0	0	0	0	0	0	-69	0	0	2
Guadalupe	-181	-1	-792	-2	-785	0	-79	-1	-147	-1	-284	0	903	-1	-1365	-6	1	60
HALL	0	0	-3	0	0	0	0	0	0	0	0	0	0	0	-3	0	0	0
HAMILTON	-3	0	-33	0	0	0	0	0	-14	0	-27	0	0	0	-77	0	0	2
HARDEMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harris	-12331	-41	-16643	-49	-26781	-7	-2708	-21	-6399	-28	-12368	-8	30465	-33	-46766	-187	50	2002
HASKELL	-1	0	0	0	-98	0	-10	0	0	0	0	0	0	0	-109	0	0	1
Hays	-646	-2	-1234	-4	-1370	0	-139	-1	-230	-1	-444	0	411	0	-3652	-9	4	96
Henderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIDALGO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HILL	-36	0	-278	-1	-79	0	-8	0	-11	0	-22	0	0	0	-435	-1	0	12
Hood	-296	-1	-349	-1	-141	0	-14	0	-24	0	-47	0	0	0	-871	-2	1	25
HOPKINS	-44	0	-94	0	-116	0	-12	0	-21	0	-41	0	76	0	-251	-1	0	8
HOUSTON	-16	0	-31	0	-197	0	-20	0	-27	0	-52	0	1	0	-341	-1	0	5
HOWARD	-36	0	-57	0	-12	0	-1	0	-21	0	-40	0	0	0	-168	0	0	4
HUDSPETH	-6	0	-49	0	0	0	0	0	0	0	0	0	0	0	-55	0	0	2
Hunt	-143	0	-452	-1	-158	0	-16	0	-51	0	-98	0	67	0	-851	-2	1	25
IRION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JACK	-11	0	-5	0	0	0	0	0	0	0	0	0	0	0	-16	0	0	1
JACKSON	-12	0	-90	0	-7	0	-1	0	0	0	0	0	2	0	-107	0	0	3
JEFF DAVIS	-55	0	-1	0	0	0	0	0	0	0	0	0	0	0	-56	0	0	2
JIM HOGG	-4	0	-47	0	0	0	0	0	-4	0	-7	0	0	0	-61	0	0	2
JIM WELLS	-2	0	-267	-1	-245	0	-25	0	-88	0	-171	0	24	0	-773	-2	1	17
Johnson	-82	0	-755	-2	-580	0	-59	0	-17	0	-32	0	406	0	-1119	-4	1	39
JONES	-70	0	-48	0	0	0	0	0	0	0	0	0	24	0	-94	0	0	4
KARNES	0	0	-38	0	-1	0	0	0	-5	0	-11	0	0	0	-55	0	0	2
Kaufman	-171	-1	-668	-2	-323	0	-33	0	-21	0	-41	0	501	-1	-756	-4	1	38
KENDALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENEDY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KENT	0	0	0	0	0	0	0	0	-9	0	-18	0	0	0	-27	0	0	1
KERR	-368	-1	-280	-1	-256	0	-26	0	-207	-1	-400	0	2	0	-1535	-3	2	37
KIMBLE	-14	0	-2	0	0	0	0	0	0	0	0	0	0	0	-16	0	0	1
KING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
KINNEY	0	0	-17	0	-5	0	-1	0	0	0	0	0	0	0	-23	0	0	1
KLEBERG	-51	0	-215	-1	-370	0	-37	0	-32	0	-62	0	6	0	-760	-1	1	15
KNOX	-7	0	-7	0	0	0	0	0	0	0	0	0	0	0	-14	0	0	0
LA SALLE	0	0	-7	0	-5	0	0	0	-6	0	-11	0	0	0	-29	0	0	1
LAMAR	-35	0	-161	0	-57	0	-6	0	-8	0	-16	0	10	0	-273	-1	0	8
LAMPASAS	-15	0	-53	0	-133	0	-13	0	-26	0	-50	0	0	0	-290	0	0	5
LAVACA	-61	0	-12	0	-2	0	0	0	-3	0	-6	0	0	0	-83	0	0	3
LEE	-6	0	-74	0	-10	0	-1	0	0	0	0	0	3	0	-89	0	0	3
LEON	-59	0	-38	0	0	0	0	0	0	0	0	0	0	0	-97	0	0	3
LIMESTONE	-25	0	-30	0	-103	0	-10	0	-14	0	-26	0	3	0	-205	0	0	4
LIVE OAK	-90	0	0	0	0	0	0	0	0	0	0	0	0	0	-90	0	0	3
LLANO	-5	0	-137	0	0	0	0	0	-219	-1	-423	0	0	0	-784	-2	1	18
LOVING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MADISON	-5	0	-56	0	-1	0	0	0	0	0	0	0	0	0	-61	0	0	2
MARTIN	0	0	-3	0	0	0	0	0	0	0	0	0	0	0	-3	0	0	0
MASON	0	0	-6	0	0	0	0	0	0	0	0	0	0	0	-6	0	0	0
MATAGORDA	-32	0	-146	0	-52	0	-5	0	-33	0	-64	0	44	0	-290	-1	0	9
MAVERICK	-109	0	-229	-1	-133	0	-13	0	-110	0	-212	0	3	0	-803	-2	1	19
MCCULLOCH	-3	0	-54	0	0	0	0	0	0	0	0	0	0	0	-57	0	0	2
MCLENNAN	-613	-2	-1499	-4	-1127	0	-114	-1	-474	-2	-917	-1	769	-1	-3974	-11	4	119
MCMULLEN	-19	0	-4	0	0	0	0	0	0	0	0	0	0	0	-22	0	0	1
MEDINA	-29	0	-113	0	-10	0	-1	0	0	0	-1	0	4	0	-149	0	0	5
MENARD	-3	0	-7	0	0	0	0	0	-1	0	-2	0	0	0	-12	0	0	0
MIDLAND	-761	-3	-331	-1	-1009	0	-102	-1	-198	-1	-382	0	114	0	-2669	-6	3	62
MILAM	-24	0	-219	-1	-112	0	-11	0	0	0	0	0	0	0	-366	-1	0	9
MILLS	-14	0	-45	0	0	0	0	0	0	0	0	0	0	0	-59	0	0	2
MITCHELL	-31	0	-1	0	-2	0	0	0	-20	0	-39	0	0	0	-94	0	0	2
MONTAGUE	-11	0	-71	0	-111	0	-11	0	-24	0	-46	0	5	0	-269	-1	0	5
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOTLEY	0	0	-4	0	0	0	0	0	0	0	0	0	0	0	-4	0	0	0

Table 51: Calculated the ASHRAE Standard 90.1-1989 and 1999 OSD Electricity and Natural Gas Savings (USDOE 2004). A decrease in energy use is negative (i.e., savings); a positive value represents an energy use increase (+) (Part 4)

Counties	Assembly		Education		Retail		Food		Lodging		Office		Warehouse		Total		Total*1.07 (T&D loss) for eGrid	
	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	kWh/yr	mBtu/yr	MWh/yr	Therm/yr
ERCOT Counties																		
(square feet in thousands)																		
NACOGDOCHES	-188	-1	-661	-2	-215	0	-22	0	-105	0	-203	0	85	0	-1308	-3	1	37
NAVARRO	-27	0	-168	0	-202	0	-20	0	-53	0	-103	0	216	0	-359	-1	0	14
NOLAN	-48	0	-97	0	-117	0	-12	0	-31	0	-60	0	0	0	-364	-1	0	8
Nueces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PALO PINTO	-37	0	-146	0	-165	0	-17	0	-10	0	-20	0	10	0	-385	-1	0	8
Parker	-83	0	-734	-2	-801	0	-81	-1	-145	-1	-280	0	40	0	-2083	-4	2	44
PECOS	-28	0	-35	0	-4	0	0	0	-37	0	-71	0	0	0	-175	0	0	4
PRESIDIO	-22	0	-27	0	0	0	0	0	0	0	0	0	2	0	-48	0	0	2
RAINS	-5	0	-45	0	0	0	0	0	0	0	0	0	0	0	-51	0	0	2
REAGAN	-12	0	0	0	0	0	0	0	-1	0	-3	0	0	0	-16	0	0	1
REAL	-4	0	-3	0	0	0	0	0	-14	0	-27	0	3	0	-46	0	0	1
RED RIVER	-14	0	-77	0	-1	0	0	0	0	0	0	0	0	0	-92	0	0	3
REEVES	-42	0	-11	0	-6	0	-1	0	-16	0	-30	0	0	0	-105	0	0	3
REFUGIO	-9	0	-4	0	0	0	0	0	0	0	0	0	0	0	-14	0	0	0
ROBERTSON	-11	0	-17	0	0	0	0	0	-5	0	-10	0	8	0	-37	0	0	1
Rockwall	-229	-1	-890	-3	-1082	0	-109	-1	-60	0	-115	0	232	0	-2254	-5	2	54
RUNNELS	0	0	-34	0	-9	0	-1	0	0	0	0	0	0	0	-44	0	0	1
Rusk	-5	0	-34	0	-121	0	-12	0	-3	0	-7	0	15	0	-168	0	0	3
San Patricio	-115	0	-318	-1	-259	0	-26	0	-75	0	-145	0	1532	-2	593	-4	-1	40
SAN SABA	-37	0	-15	0	-8	0	-1	0	0	0	0	0	0	0	-61	0	0	2
SCHLEICHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCURRY	-5	0	-1	0	-46	0	-5	0	-9	0	-17	0	74	0	-9	0	0	2
SHACKELFORD	-16	0	-22	0	0	0	0	0	-9	0	-17	0	0	0	-63	0	0	2
Smith	-690	-2	-640	-2	-986	0	-100	-1	-469	-2	-907	-1	933	-1	-2859	-9	3	95
SOMERVELL	-2	0	-38	0	-2	0	0	0	-2	0	-4	0	6	0	-43	0	0	2
STARR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STEPHENS	0	0	-34	0	0	0	0	0	-4	0	-9	0	0	0	-47	0	0	1
STERLING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STONEWALL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUTTON	0	0	-9	0	0	0	0	0	-4	0	-9	0	0	0	-22	0	0	1
Tarrant	-6384	-21	-8824	-26	-18912	-5	-1912	-15	-3908	-17	-7553	-5	11923	-13	-35571	-102	38	1090
TAYLOR	-292	-1	-277	-1	-904	0	-91	-1	-232	-1	-448	0	329	0	-1917	-4	2	47
TERRELL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THROCKMORTON	-9	0	0	0	0	0	0	0	0	0	0	0	0	0	-9	0	0	0
TITUS	-38	0	-145	0	-77	0	-8	0	0	0	-1	0	0	0	-269	-1	0	7
TOM GREEN	-528	-2	-500	-1	-587	0	-59	0	-437	-2	-845	-1	209	0	-2748	-7	3	70
Travis	-2726	-9	-2960	-9	-7329	-2	-741	-6	-2542	-11	-4914	-3	2531	-3	-18681	-42	20	454
UPTON	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	-2	0	0	0
UVALDE	-120	0	-183	-1	-375	0	-38	0	-19	0	-37	0	50	0	-722	-1	1	16
VAL VERDE	-76	0	-164	0	-81	0	-8	0	-33	0	-65	0	21	0	-407	-1	0	11
VAN ZANDT	-13	0	-230	-1	-2	0	0	0	-1	0	-2	0	2	0	-245	-1	0	8
Victoria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waller	-27	0	-66	0	-6	0	-1	0	0	0	0	0	86	0	-13	0	0	4
WARD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WASHINGTON	-261	-1	-203	-1	-378	0	-38	0	-45	0	-87	0	159	0	-852	-2	1	24
WEBB	-240	-1	-1551	-5	-606	0	-61	0	-371	-2	-717	0	751	-1	-2796	-9	3	95
WHARTON	-79	0	-90	0	-336	0	-34	0	-25	0	-48	0	72	0	-540	-1	1	12
WICHITA	-512	-2	-283	-1	-574	0	-58	0	-644	-3	-1245	-1	177	0	-3138	-7	3	74
WILBARGER	-27	0	-39	0	-98	0	-10	0	-43	0	-83	0	9	0	-291	-1	0	6
WILLACY	-16	0	-237	-1	-301	0	-30	0	-5	0	-10	0	46	0	-554	-1	1	12
Williamson	-1008	-3	-2252	-7	-3462	-1	-350	-3	-478	-2	-925	-1	756	-1	-7720	-17	8	183
Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WINKLER	-8	0	-1	0	0	0	0	0	0	0	0	0	0	0	-9	0	0	0
WISE	-158	-1	-410	-1	-11	0	-1	0	-184	-1	-356	0	0	0	-1119	-3	1	30
YOUNG	-85	0	-117	0	-256	0	-26	0	-24	0	-47	0	10	0	-545	-1	1	11
ZAPATA	-19	0	-227	-1	-9	0	-1	0	-5	0	-10	0	0	0	-272	-1	0	8
ZAVALA	-1	0	-26	0	0	0	0	0	-5	0	-9	0	1	0	-39	0	0	1
Total	-45817	-151	-78437	-231	-110706	-28	-11195	-86	-30456	-135	-58867	-37	72807	-80	-262670	-749	281	8016

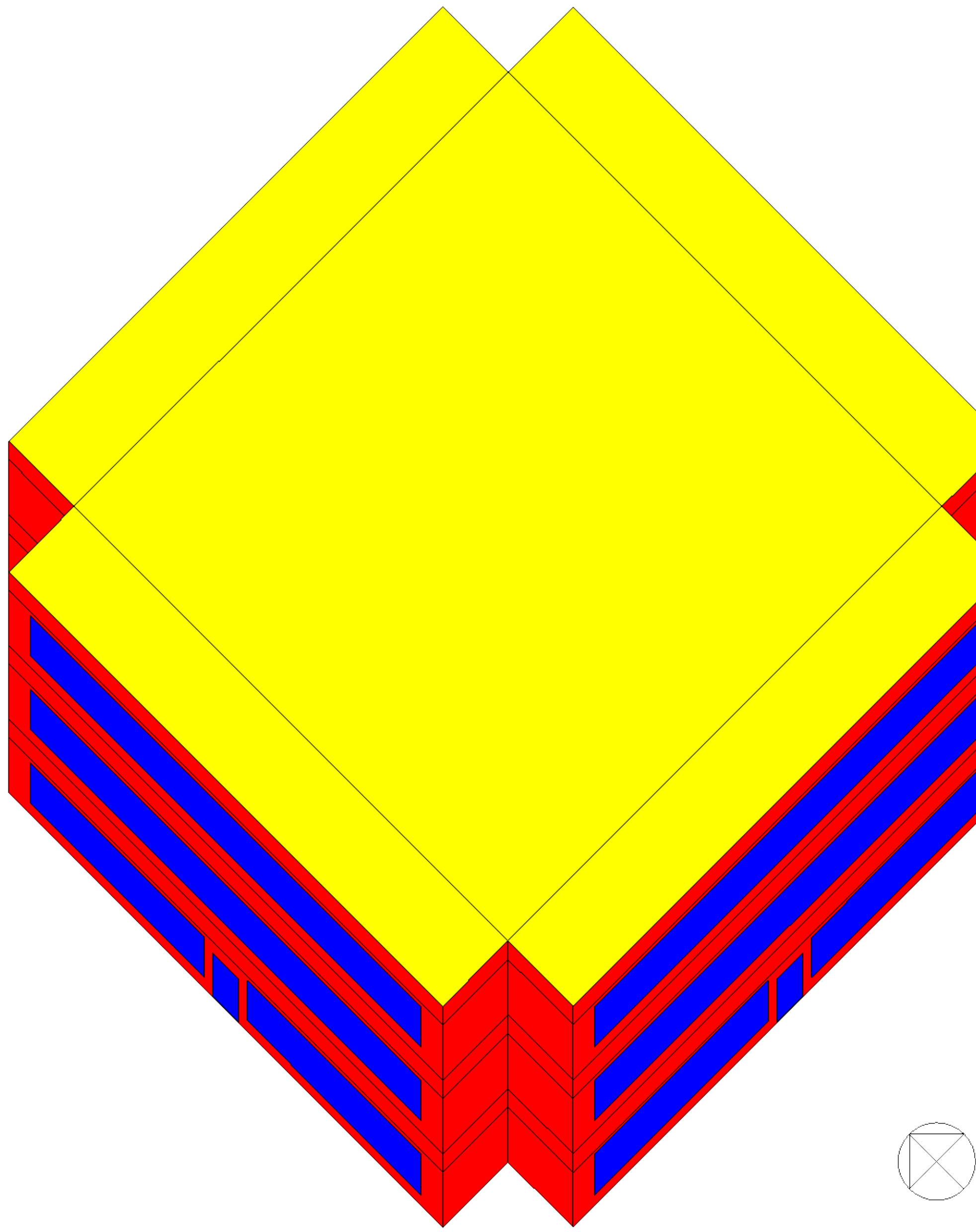


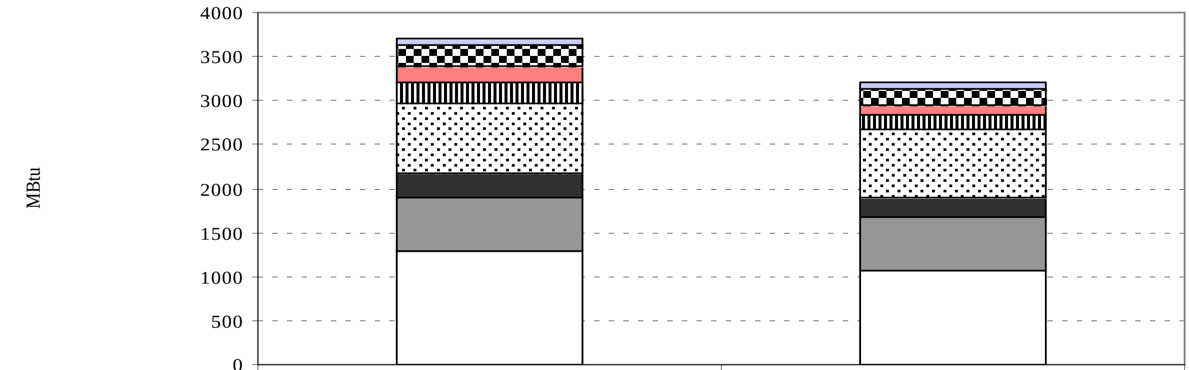
Figure 154: Typical Office Building Used for Annual to OSD calculation (3-story shown)

Table 52: Office/Retail Simulation Input Parameters (LOADS)

NAME	DESCRIPTION	DEFAULT	STATUS	COMMENT
LOADS				
b01	Quick or thermal mode (Q or T)	Quick (Q)	Fixed	Q simulates the building as massless, T will include thermal mass
b02	Location	Bastrop (BAS)	User Defined	41 counties linked to 9 TRY packed weather files according to climate zone
b03	Azimuth of building (degree)	0	User Defined	Orientation of the building
b04	Length of building (ft)	122	User Defined	
b05	Width of building (ft)	122	User Defined	
b06	Floor to ceiling height (ft)	9	User Defined	
b07	Door height (ft)	7	Fixed	
b08	Door width (ft)	6	Fixed	
b09	Run year	2000	User Defined	
b10	Floor to floor height (ft)	13	User Defined	This defines the plenum height in conjunction with b06
b11	Number of floor	6	User Defined	
b12	Perimeter depth (ft)	15	Fixed	Used for thermal zoning
b13	Void			
b14	Underground floor mode	No (N)	User Defined	This allows the user to activate/deactivate underground floors
b15	Front wall: Attached to another building?	No (N)	User Defined	These 4 parameters are used to attach buildings to the different orientations of the model for the retail scenario
b16	Right wall: Attached to another building?	No (N)	User Defined	
b17	Back wall: Attached to another building?	No (N)	User Defined	
b18	Left wall: Attached to another building?	No (N)	User Defined	
b19	Building type	Office (O)	User Defined	Allows the user to switch between Office and Retail
b20	Code compliance	Code (C)	User Defined	Allows user to run user defined model or either of ASHRAE 90.1 1989 or 1999
c01	Roof absorptance	0.45	User Defined	c01 and c03 are used to determine "roof color"
c02	Roof roughness	1	Fixed	This is used to calculate the outside film coefficient for heat transfer calculations, DOE-2 allows values from 1 to 6 increasing in smoothness
c03	Roof outside emissivity	0.89	User Defined	c01 and c03 are used to determine "roof color"
c04	Roof insulation R-value (hr-sq.ft-F/Btu)	R-15	User Defined	
c05	Wall absorptance	0.57	User Defined	c05 and c07 are used to define "wall color"
c06	Wall roughness	2	Fixed	This is used to calculate the outside film coefficient for heat transfer calculations, DOE-2 allows values from 1 to 6 increasing in smoothness
c07	Wall outside emissivity	0.9	User Defined	c05 and c07 are used to define "wall color"
c08	Wall insulation R-value (hr-sq.ft-F/Btu)	R-13	User Defined	
c09	Ground reflectance	0.24	Fixed	This defines the fraction of sunlight reflected from the ground
c10	Void			
c11	U-Factor of glazing (Btu/hr-sq.ft-F)	1.22	User Defined	
c12	Solar Heat Gain Coefficient(SHGC)	0.17	User Defined	
c13	Number of pane of glazing	1	Fixed	
c14	Frame absorptance of glazing	0.7	Fixed	
c15	Frame type - A,B,C,D,E	Aluminum w/o thermal break (A)	User Defined	Allows user to select from 5 different frame types
c16	Void			
c17	Floor weight (lb/sq-ft)	70	User Defined	This corresponds to medium construction, user has a choice of light, medium or heavy construction
c18	Slab-on-grade floor insulation R-value (Exterior insulation, horizontal) (hr-sq.ft-F/Btu)	R-0 (A)	User Defined	User can choose from 9 insulation R-values and insulation depths
c19	Slab-on-grade floor R-value (hr-sq.ft-F/Btu)	0.88	Fixed	
c20	Below-grade wall insulation R-value (hr-sq.ft-F/Btu) (Exterior insulation, vertical, basement wall = 8 ft)	R-0 (A)	User Defined	User can choose from 9 insulation R-values
c21	Below-grade wall R-value (concrete wall) (hr-sq.ft-F/Btu)	0.88	Fixed	
c22	Void			
c23	Floor R-value	1.67	Fixed	
c24	Void			
c25	Ceiling R-value (hr-sq.ft-F/Btu)	1.89	Fixed	
c26	Interior wall R-value (hr-sq.ft-F/Btu)	2.01	Fixed	
c27	Percent window-front (%)	50	User Defined	
c28	Percent window-right (%)	50	User Defined	
c29	Percent window-back (%)	50	User Defined	
c30	Percent window-left (%)	50	User Defined	
sp01	void			
sp02	void			
sp03	Area per person (ft^2/person) for office	275	User Defined	
sp04	Lighting load (W/ft2) for office	1.3	User Defined	
sp05	Equipment load (W/ft2) for office	0.75	User Defined	
sp06	Area per person (ft^2/person) for retail	300	User Defined	
sp07	Lighting load (W/ft2) for retail	1.9	User Defined	
sp08	Equipment load (W/ft2) for retail	0.25	User Defined	
s01	Front Shade (S)	0	User Defined	
s02	Back Shade (N)	0	User Defined	
s03	Left Shade (W)	0	User Defined	
s04	Right Shade (E)	0	User Defined	

Table 53: Office/Retail Simulation Input Parameters (SYSTEMS and PLANT)

NAME	DESCRIPTION	DEFAULT	STATUS	COMMENT
SYSTEM				
sy01	Mode of system	Variable air volume (2)	User Defined	User can choose from Packaged single zone, variable air volume or packaged variable volume system
sy02	Cooling Capacity of cooling system (Btu/hr)	0	Fixed	DOE-2 is autosizing the system
sy03	Heating Capacity of heating system (Btu/hr)	0	Fixed	DOE-2 is autosizing the system
sy04	Seasonal Energy Efficiency Ratio (SEER) for PVAVS and PSZ	10	User Defined	
sy05	ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE) for PSZ	0.8	User Defined	
sy06	**Spare parameter for systems other than VAVS**HEATING SEASONAL PERFORMANCE FACTOR (HSPF)	6.8	User Defined	Unused, since heatpump systems are not included in the office/retail scenario
sy07	**Spare parameter for Pilot light	0	Fixed	Unused
sy08	**Spare parameter for Pilot light	0	Fixed	Unused
sy09	**Spare parameter for Pilot light	0	Fixed	Unused
sy10	Void			
sy11	Exterior lighting (kW)	0	Fixed	
sy12	Void			
sy13	Fan control type	Variable frequency drives (1)	User Defined	User can choose from 4 different type of fan control
sy14	Economizer type	None (1)	User Defined	
sy15	Economizer drybulb limit (F) (use when economizer type(sy14) = dry bulb(2))	65	Fixed	This corresponds to the temperature above which the outside air dampers return to the minimum position
sy16	User input for numbers of fans	Autosized (A)	Fixed	Autosized by DOE-2
sy17	Number of Fans	6	Fixed	equal to the number of floors
sy18	Supply fan total pressure (in W.G)	5.5	Fixed	
sy19	Supply fan efficiency	0.54	Fixed	
sy20	Return fan total pressure (in W.G)	2	Fixed	
sy21	Return fan efficiency	0.51	Fixed	
sy22	Supply motor efficiency	0.5	Fixed	
sy23	Return motor efficiency	0.5	Fixed	
sy24	User input for DHW gallon/hr-person	Autosized (A)	Fixed	The size of DHW depends on the gallons per hour per person requirements of ASHRAE 90.1
sy25	Maximum DHW gallon/h-person (maximum hourly, to be used with occupancy schedule)	0.4	Fixed	
PLANT				
p01	Chiller type	Electric Centrifugal (1)	Fixed	
p02	Number of chillers	1	Fixed	
p03	Chillers size (MBtu/h)	-999	Fixed	Chiller is being autosized by DOE-2
p04	Condenser type	water-cooled (W)	Fixed	
p05	COP	5	User Defined	
p06	Switch for a chiller sizing	Autosized (A)	Fixed	Chiller is being autosized by DOE-2
p07	Cooling tower type	Open tower (O)		
p08	Void			
p09	Gpm/hp	38.2	Fixed	Value from ASHRAE 90.1 1999 for axial fan cooling towers
p10	Cooling tower capacity control	Two-speed fan (1)	Fixed	
p11	Boiler type	Gas fired-hotwater boiler (1)	User Defined	User can choose from gas fired or electric boilers
p12	Number of boilers	1	Fixed	
p13	Boiler size (MBtu/h)	-999	Fixed	Boiler is being autosized by DOE-2
p14	Boiler fuel type	Gas (G)	Fixed	Depends on the value of p10
p15	Boilers efficiency (Et,Ec,AFUE) (%)	80	User Defined	
p16	Switch for a boiler sizing	Autosized (A)	Fixed	Boiler is being autosized by DOE-2
p17	Void			
p18	DHW heater type	Gas water heater (1)	User Defined	User can choose from gas fired or electric water heaters
p19	Number of DHW heater	1	Fixed	
p20	DHW size (MBtu/h)	-999	Fixed	Water heater is being autosized by DOE-2
p21	DHW fuel type	Gas (G)	Fixed	Depends on the value of p18
p22	DHW heater Efficiency (Et,Ec,Energy factor) (%)	54	User Defined	
p23	Switch for a DHW heater sizing	Autosized (A)	Fixed	Water heater is being autosized by DOE-2
p24	DHW Storage Capacity (gal)	75	Fixed	



	ASHRAE 90.1-1989	ASHRAE 90.1-1999
DOMHOT WATER	71.5	71.5
VENT FANS	239.2	177.9
PUMPS & MISC	184.1	111.2
HEAT REJECT	233.9	174.3
SPACE COOL	798.1	774.3
SPACE HEAT	272.1	214.3
MISC EQUIPMT	616.2	616.2
AREA LIGHTS	1289.9	1068.1

AREA LIGHTS MISC EQUIPMT SPACE HEAT SPACE COOL HEAT REJECT PUMPS & MISC VENT FANS DOMHOT WATER

Figure 155: Comparison of Annual energy Use the ASHRAE Standard 90.1-1989 vs. 90.1-1999

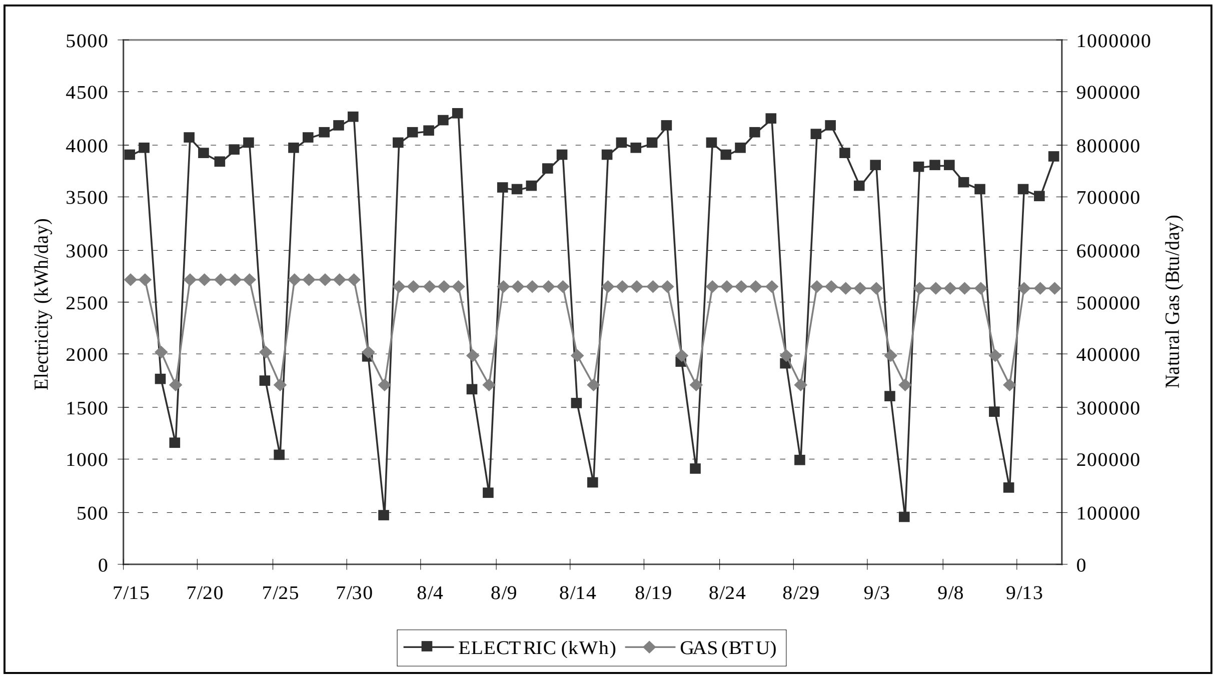


Figure 156: Simulated Electricity and Natural Gas for Building Built to the 90.1-1989 Standard for OSD (07/15-09/15)

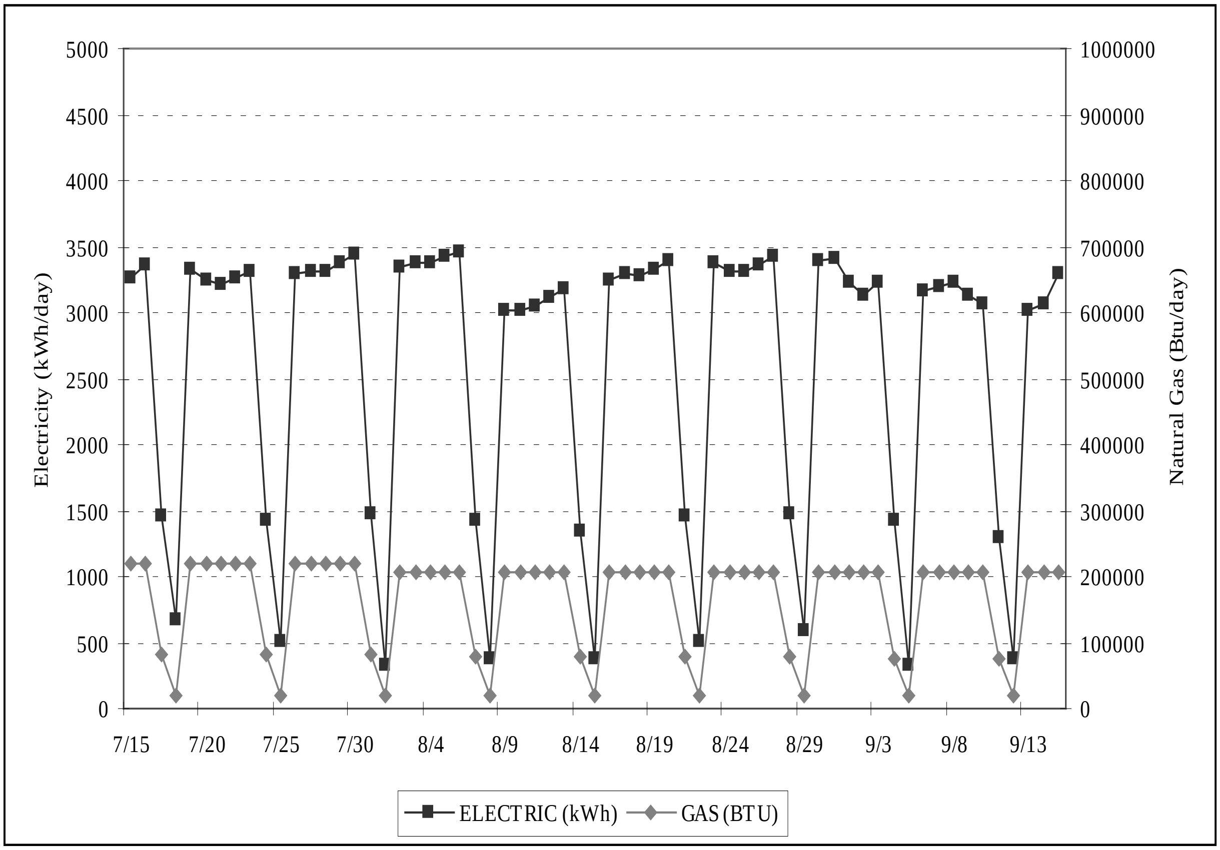


Figure 157: Simulated Electricity and Natural Gas for Building Built to the 90.1-1999 Standard for OSD (07/15-09/15)

Table 54: Simulated Electricity and Natural Gas for Building Built to the 90.1-1989 and 1999 Standard for Annual and OSD (07/15-09/15)

	Electricity (kW)		Gas (Btu)	
	1989	1999	1989	1999
TOTAL (YEAR) (a)	988,405	858,198	331,600,000	278,800,000
OSD (07/15 - 09/15)	199,537	163,841	30,633,205	10,332,355
OSD PER DAY (b)	3167	2601	486241	164006
OSD % (b/a)	0.32%	0.30%	0.15%	0.06%

Table 55: Totalized Annual Electricity Savings from the 90.1-1999 by PCA for Commercial Buildings

PCA	Total Electricity Savings by PCA (MWh)
American Electric Power - West (ERCOT)/PCA	4,773.76
Austin Energy/PCA	183.04
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	916.80
Reliant Energy HL&P/PCA	10,382.09
San Antonio Public Service Bd /PCA	7,168.26
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	451.99
TXU Electric/PCA	31,083.51
El Paso Electric Co/PCA	43.49
Entergy Electric System/PCA	3,060.77
Total	58,063.71

Table 56: 2010 Annual NOx Reductions from the 90.1-1999 by PCA for Commercial Buildings by County using 2007 eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00883113	42.157686	0.010890729	1.99341709	0.006522185	0	0.003944232	3.616055598	0.0654443	679.4488362	0.014877434	106.6453347	0.006262315	0	0.0048171	0	0.121274957	54.81451495	0.00816387	253.7617704	1142.437615	0.571218807
	Chambers	0.02176222	103.887577	0.026955801	4.933935492	0.016072371	0	0.009076193	8.32101662	0.1649402	1712.425045	0.037472294	268.6111989	0.015055623	0	0.0095532	0	0.011518588	5.20623418	0.01581859	491.697435	2595.082442	1.297541221
	Fort Bend	0.07043123	336.221647	0.087239726	15.96818378	0.052016606	0	0.029374182	26.93012968	0.5338124	5542.090663	0.121275295	869.3330092	0.048726002	0	0.030918	0	0.037278747	16.84945098	0.05119528	1591.329076	8398.72216	4.19936108
	Galveston	0.03385674	161.623871	0.041710519	7.634609305	0.025004711	0	0.015351589	14.07427363	0.2495874	2591.239814	0.056747051	406.7776961	0.024143087	0	0.0192972	0	0.567751219	256.6152862	0.03283689	1020.685823	4458.651372	2.229325686
	Harris	0.06826733	325.891706	0.084559408	15.47758363	0.050418468	0	0.028471701	26.10273905	0.5174117	5371.817667	0.117549281	842.6239665	0.047228963	0	0.0299681	0	0.03613341	16.33177512	0.04962237	1542.437712	8140.68315	4.070341575
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00203914	9.73433719	0.003716345	0.680232237	0.001505992	0	0.005950953	5.455809054	0.0024815	25.76294165	0.000717051	5.140007103	0.019166247	0	0.0766809	0	0.00086441	0.390700803	0.0040002	124.3402508	171.5042789	0.085752139
	Dallas	0.00453947	21.6703355	0.004683963	0.857343082	0.003352602	0	0.00774211	7.09793468	0.0020856	21.65301308	0.00068106	4.882018436	0.007502816	0	0.026717	0	0.007524933	3.401160209	0.04037045	1254.855565	1314.41737	0.657208685
	Denton	0.00047388	2.26218971	0.000872802	0.159755832	0.000349982	0	0.001396994	1.280758231	0.0005854	6.078128426	0.000168971	1.211224819	0.00454374	0	0.0181872	0	0.000186605	0.084342967	0.00084941	26.40250408	37.47890406	0.018739452
	Tarrant	0.01216249	58.0607918	0.012266309	2.245200562	0.008982543	0	0.020308652	18.61888911	0.0053165	55.19645345	0.001752506	12.56242163	0.017326428	0	0.0602168	0	0.020603444	9.31245693	0.11064724	3439.304924	3595.301138	1.797650569
	Ellis	0.00327981	15.6570352	0.003307809	0.605454786	0.002422289	0	0.005476558	5.020885754	0.0014337	14.88461987	0.000472592	3.387660964	0.004672353	0	0.0162384	0	0.005556053	2.511255213	0.02983782	927.4644153	969.5313271	0.484765664
	Johnson	0.00028606	1.36557388	0.000526868	0.096436824	0.000211267	0	0.000843297	0.77313144	0.0003534	3.669070455	0.000101999	0.731157502	0.002742835	0	0.0109787	0	0.000112645	0.050913746	0.00051274	15.93790734	22.62419119	0.011312096
	Kaufman	0.00632545	30.1961779	0.006379446	1.167680865	0.004671629	0	0.010562096	9.683286608	0.002765	28.70649669	0.000911441	6.533447215	0.009011105	0	0.0313175	0	0.010715411	4.843209977	0.05754527	1788.709043	1869.839342	0.934919671
	Parker	0.00021749	1.03824209	0.000400576	0.073320654	0.000160626	0	0.000641157	0.587809723	0.0002687	2.789584248	7.75498E-05	0.555897052	0.00208537	0	0.0083471	0	8.56434E-05	0.038709582	0.00038984	12.11754743	17.20111078	0.008600555
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00081989	3.91397977	0.000826893	0.151352906	0.000605529	0	0.001369042	1.255131958	0.0003584	3.720889699	0.00011814	0.846854867	0.001168005	0	0.0040593	0	0.001388914	0.627769048	0.00745892	231.8495748	242.3655531	0.121182777
	Hood	0.01252711	59.8013879	0.012634039	2.312509104	0.009251829	0	0.020917482	19.17706208	0.0054759	56.85117992	0.001805044	12.93902865	0.017845854	0	0.062022	0	0.021221112	9.591633724	0.11396431	3542.411348	3703.084149	1.851542075
	Hunt	0.00618756	29.5379046	0.006240374	1.142225553	0.004569788	0	0.010331844	9.472192043	0.0027047	28.08069827	0.000891572	6.391018796	0.008814664	0	0.0306347	0	0.010481817	4.737628541	0.05629078	1749.715386	1829.077054	0.914538527
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03341375	159.509153	0.051775843	9.476946068	0.024677545	0	0.090663423	83.1198552	0.0011418	11.85470411	1.143571754	8197.421227	0.046873844	0	0.0046695	0	0.000519582	0.234843648	0.00250387	77.82892789	8539.445657	4.269722828
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200047	9.54974564	0.076378745	13.98021155	0.001477434	0	0.133848731	122.711968	0.0012371	12.8440296	0.003554796	25.48170878	0.001061766	0	0.0018557	0	0.000401718	0.181570837	0.00183516	57.04337096	241.7926054	0.120896303
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00450233	21.4930509	0.171901148	31.4644399	0.003325174	0	0.301245466	276.1806093	0.0027843	28.90730202	0.008000571	57.35018328	0.002389654	0	0.0041765	0	0.000904124	0.408650803	0.0041303	128.3841601	544.1883963	0.272094198
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.0024586	11.7367567	0.093870431	17.18185467	0.001815785	0	0.164501762	150.814542	0.0015205	15.78547286	0.004368889	31.31733847	0.001304924	0	0.0022807	0	0.000493717	0.223152827	0.00225544	70.10701564	297.1661331	0.148583067
	Travis	0.00051001	2.43464992	0.299602906	54.83871232	0.000376663	0	0.033939476	31.11557278	0.0003347	3.474978317	0.000906121	6.495312228	0.000271138	0	0.0004717	0	0.000103327	0.04670224	0.00046734	14.52643784	112.9323656	0.056466183
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.00068596	3.27462997	0.00069182	0.126629362	0.000506616	0	0.001145408	1.050105765	0.0002999	3.113081217	9.88414E-05	0.708520863	0.000977211	0	0.0033962	0	0.001162035	0.52522278	0.00624051	193.9768752	202.7750651	0.101387533
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	1086.35799	0.004556851	0.834076883	0.168069652	0	0.007612767	6.979353707	0.0016809	17.45113701	0.001626796	11.6612988	0.046792036	0	0.0072464	0	0.001609426	0.727437106	0.00828339	257.4770138	1381.488303	0.690744152
	San Patricio	0.05031335	240.18375	0.001007478	0.184406721	0.037158653	0	0.001683113	1.543070855	0.0003716	3.858285742	0.00035967	2.578205814	0.010345288	0	0.0016021	0	0.000355829	0.160829648	0.00183138	56.92579751	305.4343463	0.152717173
Victoria Area	Victoria	0.02183674	104.243286	0.002215582	0.405535697	0.016127403	0	0.003612695	3.312104222	0.0011996	12.45458012	0.000555389	3.981172038	0.52545648	0	0.0324127	0	0.000476855	0.215531671	0.00225485	70.08863511	194.7008448	0.097350422
Other ERCOT counties	Andrews	2.4742E-05	0.11811271	2.49533E-05	0.004567398	1.82731E-05	0	4.13138E-05	0.03787629	1.082E-05	0.112285803	3.56511E-06	0.025555656	3.5247E-05	0	0.0001225	0	4.19135E-05	0.018944273	0.00022509	6.996556651	7.31389878	0.003656949
	Angelina	0.00031082	1.483779	0.000313473	0.057377472	0.000229554	0	0.000519	0.475817083	0.0001359	1.41057908	4.47864E-05	0.321040358	0.000442787	0	0.0015389	0	0.000526534	0.237985525	0.00282766	87.89353795	91.88011646	0.045940058
	Bosque	0.00059539	2.84225608	0.001096604	0.200720117	0.000439723	0	0.001755208	1.609167809	0.0007356	7.636670502	0.000212298	1.521804772	0.005708837	0	0.0228507	0	0.000234455	0.105970029	0.00106721	33.17258372	47.08917303	0.023544587
	Brazos	0.00193973	9.25977821	0.003572622	0.653925515	0.001432574	0	0.005718288	5.242503352	0.0023964	24.8794877	0.000691644	4.957883556	0.018598805	0	0.0744451	0	0.000763829	0.345239464	0.00347685	108.0728687	153.4116865	0.076705843
	Calhoun	0.08269981	394.788852	0.001655986	0.303108422	0.061077496	0	0.002766524	2.536337994	0.0006108	6.341845346	0.000591187	4.237784247	0.0170045	0	0.0026334	0	0.000584875	0.264354903	0.00301023	93.56865409	502.0409366	0.251020468
	Cameron	0.04837175	230.915001	0.000968599	0.177290421	0.297964476	0	0.001618161	1.48352338	0.0003573	3.709393569	0.00034579	2.478712232	0.009946061	0	0.0015403	0	0.000342098	0.154623193	0.00176071	54.72901732	293.6475616	0.146823781
	Cherokee	0.0035039	16.7267645	0.003533808	0.646821028	0.002587786	0	0.00585073	5.363925695	0.0015316	15.90157572	0.00050488	3.61911475	0.00499158	0	0.0173479	0	0.005935657	2.682830685	0.03187642	990.8311904	1035.772223	0.517886111
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.00129879	6.20009392	2.6007E-05	0.004760268	0.000959212	0	4.34478E-05	0.039832771	9.593E-06	0.099597637	9.2845E-06	0.066553704	0.000267053	0	4.136E-05	0	9.18536E-06	0.00415165	4.7275E-05	1.469480308	7.884470256	0.003942235
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00353575	16.8788026	0.003565928	0.652700316	0.002611307	0	0.005903911	5.412681167	0.0015456	16.0461133	0.00050947	3.65201074	0.005036951	0	0.0175056	0	0.00598961	2.707216309	0.03216616	999.8373633	1045.186888	0.522593444
	Fannin	0.00705631	33.6851369	0.007116546	1.302598293	0.005211403	0	0.011782473	10.80212324	0.0030845	32.02333335	0.001016752	7.288341741	0.010052276	0	0.034936	0	0.011953503	5.402809309	0.06419422	1995.381971	2085.886314	1.042943157
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00367718	17.5539547	0.003708565	0.678808328	0.00271576	0	0.006140067	5.629188414	0.0016074	16.68795783	0.000529848	3.79809117	0.005238429	0	0.0182058	0	0.006229194	2.815504961	0.03345281	1039.830858	1086.994363	0.543497182
	Frio	0.00858833	40.998629	0.000871383	0.159496196	0.006342868	0	0.001420864	1.302642478	0.0004718	4.898355856	0.000218433	1.565785211	0.206660746	0	0.0127478	0	0.000187546	0.084768078	0.00088683	27.56568851	76.57536536	0.038287683
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.18852746	899.984402	0.003775086	0.690984182	0.139235931	0	0.006306735	5.781988581	0.0013925	14.45725194	0.001347706	9.660707756	0.03876448	0	0.0060032	0	0.001333316	0.60263933	0.00686231	213.3047294	1144.482703	0.572241351
	Howard	0.00055511	2.64997521	0.000559851	0.102474073	0.000409976	0	0.000926915	0.849791967	0.0002427	2.519242822	7.99868E-05	0.573366377	0.000790802	0	0.0027484	0	0.00094037	0.425033472	0.00505009	156.9746551	164.094539	0.08204727
	Jack	0.00212145	10.1272816	0.002139557	0.391620189	0.001566784	0	0.003542346	3.2476087	0.0009273	9.627667979	0.000305682	2.191206444	0.00302217	0	0.0105033	0	0.003593766	1.624329785	0.0192997	599.902418	627.1121327	0.313556066
	Jones	0.04071872	194.381315	0.000815354	0.149240824	0.030072592	0	0.001362147	1.248811138	0.0003008	3.12252039	0.000291082	2.086548472	0.008372468	0	0.0012966	0	0.000287974	0.13015984	0.00148214	46.07019161	247.1887874	0.123594394
	Lamar	0.00095084	4.53906952	0.000958954	0.175525016	0.000702236	0	0.001587687	1.455585248	0.0004156	4.315141624	0.000137007	0.98210347	0.001354543	0	0.0047076	0	0.001610734	0.728028125	0.00865017	268.877562	281.073015	0.140536508
	Limestone	0.00071976	3.43594451	0.000891528	0.163183406	0.000531572	0	0.000300183	0.275206645	0.0054552	56.63619872	0.001239347	8.883960954	0.000497945	0	0.000316	0	0.000380962	0.172189326	0.00052318	16.26224384	85.8289274	0.042914464
	Llano	0.00123817	5.91074249	0.047274044	8.652945702	0.000914447	0	0.082844655	75.95164013	0.0007657	7.94971452	0.002200214	15.77171001	0.000657172	0	0.0011486	0	0.000248641	0.11238189	0.00113586	35.30656098	149.6556957	0.074827848
	McLennan	0.02453432	117.120887	0.024743738	4.529044002	0.018119687	0	0.040966843	37.55823397	0.0107245	111.342911	0.003535175	25.34105919	0.034951066	0	0.1214699	0	0.041561501	18.78519358	0.22319886	6937.804845	7252.482173	3.626241087
	Milam	0.0022454	10.7190191	0.002264571	0.414502574	0.001658332	0	0.003749326	3.43736662	0.0009815	10.19021304	0.000323543	2.319238733	0.003198756	0	0.011117	0	0.00380375	1.719239446	0.02042738	634.9547427	663.7543222	0.331877161
	Mitchell	0.01494317	71.3350674	0.015070721	2.758514451	0.011036196	0	0.024951762	22.87567335	0.006532	67.81586333	0.002153177	15.43453275	0.02128772	0	0.073984	0	0.025313952	11.44153776	0.1359442	4225.623534	4417.284723	2.208642362
	Nolan	0.00056465	2.69551999	0.000569473	0.104235282	0.000417022	0	0.000942846	0.864397231	0.0002468	2.562540721	8.13615E-05	0.58322075	0.000804394	0	0.0027956	0	0.000956532	0.432338467	0.00513689	159.6725581	166.9148105	0.083457405
	Palo Pinto	0.003207	15.3094332	0.005906709	1.081152134	0.002368511	0	0.009454195	8.667567717	0.003962	41.13390681	0.001143513	8.196998374	0.030749889	0	0.1230821	0	0.001262858	0.570793423	0.00574838	178.6796965	253.6395481	0.126819774
	Pecos	4.0968E-05	0.19556977	4.13174E-05	0.007562649	3.02565E-05	0	6.84069E-05	0.062715162	1.791E-05	0.185921645	5.90308E-06	0.042314786	5.83617E-05	0	0.0002028	0	6.93999E-05	0.031367728	0.0003727	11.58482456	12.11027631	0.006055138
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00073771	3.521638	0.000835096	0.152854362	0.00054483	0	0.000735917	0.674685745	0.0031497	32.70025349	0.000730875	5.239105149	0.00076086	0	0.0018663	0	0.191632518	86.61510858	0.00339774	105.6136175	234.5172628	0.117258631
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.00569644	27.193412	0.005745061	1.051564437	0.004207073	0	0.009511781	8.72036199	0.00249	25.85186753	0.000820806	5.883748676	0.008115023	0	0.0282032	0	0.00964985	4.361591875	0.05182285	1610.83638	1683.898927	0.841949463
	Tom Green	0.00148245	7.07684786	2.96846E-05	0.005433416	0.001094854	0	4.95918E-05	0.045465514	1.095E-05	0.113681717	1.05974E-05	0.075965049	0.000304817	0	4.72E-05	0	1.04843E-05	0.004738734	5.396E-05	1.677279201	8.999411492	0.004499706
	Upton	3.1166E-05	0.14877954	3.14322E-05	0.005753279	2.30176E-05	0	5.20405E-05	0.047710506	1.362E-05	0.141439734	4.49076E-06	0.032190937	4.43986E-05	0	0.0001543	0	5.27959E-05	0.023862972	0.00028353	8.813145439	9.212882406	0.004606441
	Ward	0.01855953	88.5986933	0.01871795	3.426095817	0.013707039	0	0.030990277	28.41175936	0.0081128	84.22781532	0.002674262	19.16980645	0.026439509	0	0.0918886	0	0.03144012	14.21047646	0.16884373	5248.256398	5486.301045	2.743150522
	Webb	0.02001433	95.5435495	0.000400768	0.073355806	0.014781473	0	0.000669531	0.613823652	0.0001478	1.53480123	0.000143074	1.025593675	0.004115289	0	0.0006373	0	0.000141547	0.063976998	0.00072851	22.64471578	121.4998167	0.060749908
	Wharton	0.00014434	0.68904275	0.000178787	0.032724726	0.000106601	0	6.01986E-05	0.055189815	0.001094	11.35779747	0.000248538	1.78158548	9.98576E-05	0	6.336E-05	0	7.6398E-05	0.034530769	0.00010492	3.261222967	17.21209398	0.008606047
	Wichita	0.00020763	0.99119064	0.000209406	0.038329167	0.000153346	0	0.000346701	0.317854237	9.076E-05	0.942291802	2.99181E-05	0.214460643	0.00029579	0	0.001028	0	0.000351734	0.158978544	0.00188893	58.71443966	61.3775447	0.030688772
	Wilbarger	0.02861682	136.609757	0.000573025	0.104885352	0.021134796	0	0.000957307	0.877655271	0.0002114	2.194484335	0.00020457	1.466410901	0.005884109	0	0.0009112	0	0.000202386	0.091475377	0.00104164	32.37779139	173.7224595	0.08686123
	Wise	0.00284449	13.5788945	0.002882008	0.527516945	0.002100781	0	0.00476997	4.373089396	0.0012561	13.04069332	0.000413241	2.962221564	0.004181914	0	0.0146143	0	0.004797945	2.168601109	0.02576141	800.7551798	837.4061966	0.418703098
	Young	0.00623586	29.7684674	0.006289085	1.151141373	0.004605458	0	0.010412491	9.546128724	0.0027258	28.29988657	0.000898531	6.440904896	0.008883468	0	0.0308739	0	0.010563634	4.774608843	0.05673017	1763.373064	1843.354202	0.921677101
	Total	**1.12183722**	**5355.37911**	**1.172570094**	**214.6248678**	**1.090766584**	**0**	**1.189130767**	**1090.190217**	**1.62936**	**16916.16997**	**1.542362643**	**11056.05855**	**1.359385821**	**0**	**1.2316428**	**0**	**1.221806085**	**552.2385645**	**1.52878695**	**47520.07008**	**82704.73136**	**41.35236568**

Energy Savings by PCA (MWh)																				
	4,773.76		183.04		0.00		916.80		10,382.09		7,168.26		0.00		0.00		451.99		31,083.51

Table 57: 2010 Totalized OSD Electricity Savings from the 90.1-1999 by PCA for Commercial Building (w/7% T&D)

PCA	Total Electricity Savings by PCA (MWh)
American Electric Power - West (ERCOT)/PCA	29.06
Austin Energy/PCA	1.03
Brownsville Public Utils Board/PCA	0.00
Lower Colorado River Authority/PCA	4.92
Reliant Energy HL&P/PCA	74.08
San Antonio Public Service Bd /PCA	42.14
South Texas Electric Coop Inc/PCA	0.00
Texas Municipal Power Pool/PCA	0.00
Texas-New Mexico Power Co/PCA	2.47
TXU Electric/PCA	197.47
El Paso Electric Co/PCA	0.22
Entergy Electric System/PCA	23.16
Total	374.56

Table 58: 2010 OSD NOx Reductions from Electricity Savings from the 90.1-1999 by PCA for Commercial Buildings by County using 2007 eGRID (w/7% T&D)

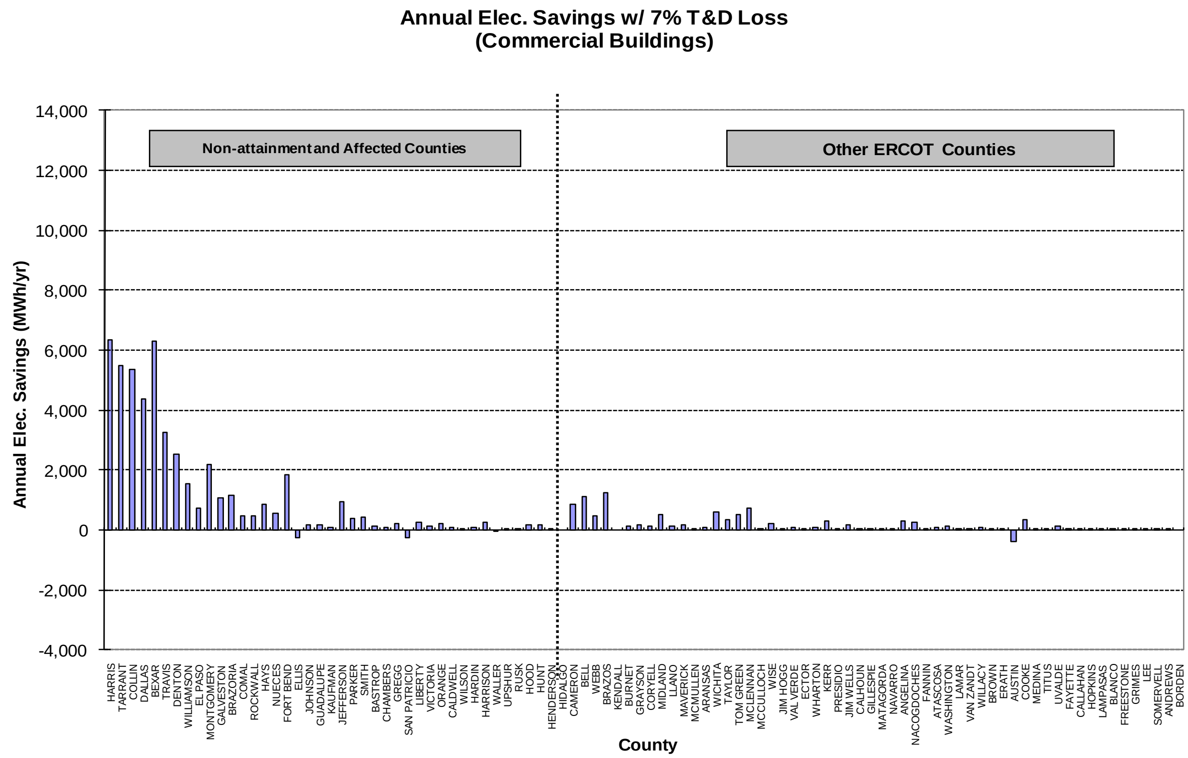
Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs/year)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00957217	0.27816581	0.011806715	0.012157533	0.007069474	0	0.004263638	0.020992488	0.0710018	5.259801803	0.016140391	0.680229075	0.006781035	0	0.0051797	0	0.126288	0.311448413	0.008772	1.732173298	8.294968416	0.004147484
	Chambers	0.0218814	0.63587006	0.027103415	0.027908751	0.016160386	0	0.009125896	0.044932349	0.1658435	12.28566246	0.037677498	1.587900212	0.01513807	0	0.0096055	0	0.011582	0.028562413	0.015905	3.140864708	17.75170095	0.00887585
	Fort Bend	0.05569551	1.61850321	0.068987309	0.071037161	0.041133619	0	0.023228475	0.114367944	0.4221274	31.27114391	0.095901908	4.041740216	0.038531479	0	0.0244493	0	0.029479	0.072700949	0.040484	7.994557283	45.18405067	0.022592025
	Galveston	0.02755599	0.80077278	0.033893644	0.034900741	0.020351324	0	0.012791501	0.062980361	0.2014466	14.92314082	0.045812515	1.930746628	0.019823685	0	0.0167751	0	0.594657	1.466526936	0.028709	5.66936644	24.88843471	0.012444217
	Harris	0.07736057	2.2480866	0.09582276	0.098669986	0.057134232	0	0.032264145	0.158856061	0.5863312	43.43534163	0.1332069	5.613941324	0.053519883	0	0.0339599	0	0.040946	0.100980974	0.056232	11.10436918	62.76024576	0.031380123
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.00176365	0.05125137	0.003151138	0.003244769	0.001302533	0	0.005050143	0.024864932	0.0020858	0.154512186	0.00060408	0.025458663	0.015958397	0	0.0637888	0	0.000846	0.002086719	0.004013	0.792503593	1.053922234	0.000526961
	Dallas	0.00504555	0.14662301	0.005305276	0.005462914	0.003726366	0	0.008757286	0.043117461	0.0024131	0.178761156	0.000782263	0.032968113	0.009310387	0	0.033672	0	0.008209	0.020245272	0.044002	8.689281071	9.116458995	0.004558229
	Denton	0.00063576	0.01847503	0.001170951	0.001205744	0.000469535	0	0.001874207	0.009227864	0.0007854	0.058184615	0.000226691	0.009553778	0.006095882	0	0.0243999	0	0.00025	0.000617407	0.00114	0.225033768	0.322298201	0.000161149
	Tarrant	0.01557224	0.45252704	0.015705165	0.01617182	0.011500796	0	0.026002176	0.12802457	0.006807	0.504260566	0.002243821	0.094564751	0.022183886	0	0.0770985	0	0.02638	0.06505674	0.141667	27.9755603	29.23616579	0.014618083
	Ellis	0.00350282	0.10179153	0.003532723	0.003637693	0.002586991	0	0.005848935	0.028797873	0.0015312	0.113428476	0.000504725	0.021271415	0.004990048	0	0.0173426	0	0.005934	0.014633877	0.031867	6.292828323	6.576389183	0.003288195
	Johnson	0.00033718	0.00979828	0.000621017	0.00063947	0.00024902	0	0.000993991	0.004894025	0.0004166	0.030858382	0.000120226	0.005066874	0.003232969	0	0.0129406	0	0.000133	0.000327443	0.000604	0.119347322	0.170931801	8.54659E-05
	Kaufman	0.00649275	0.18867841	0.006548174	0.006742743	0.004795187	0	0.01084145	0.053379069	0.0028381	0.21024839	0.000935547	0.0394282	0.009249437	0	0.0321458	0	0.010999	0.027125014	0.059067	11.66424047	12.1898423	0.006094921
	Parker	0.00047595	0.01383108	0.000876616	0.000902664	0.000351511	0	0.0014031	0.006908317	0.000588	0.043559135	0.000169709	0.007152308	0.0045636	0	0.0182667	0	0.000187	0.000462213	0.000853	0.168468525	0.241284244	0.000120642
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.00095027	0.02761473	0.000958382	0.000986859	0.000701818	0	0.001586741	0.007812493	0.0004154	0.030771688	0.000136926	0.005770662	0.001353736	0	0.0047048	0	0.00161	0.003969983	0.008645	1.707163485	1.784089904	0.000892045
	Hood	0.01232788	0.35824639	0.012433111	0.012802542	0.00910469	0	0.020584816	0.101351602	0.0053888	0.399201621	0.001776337	0.074862887	0.017562038	0	0.0610356	0	0.020884	0.051502651	0.112152	22.14706	23.14502769	0.011572514
	Hunt	0.00635121	0.18456524	0.006405424	0.006595752	0.004690653	0	0.010605108	0.052215412	0.0027763	0.205664998	0.000915153	0.03856867	0.0090478	0	0.031445	0	0.010759	0.026533692	0.05778	11.40996133	11.9241051	0.005962053
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.03112811	0.9045783	0.048234164	0.049667368	0.0229895	0	0.084461674	0.415856326	0.0010637	0.078801326	1.065346769	44.89853197	0.043667482	0	0.0043501	0	0.000484	0.001193729	0.002333	0.460625665	46.80925468	0.023404627
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.00200761	0.05834086	0.076651484	0.078929065	0.00148271	0	0.134326688	0.661372196	0.0012416	0.091973896	0.00356749	0.150350167	0.001065557	0	0.0018623	0	0.000403	0.000994245	0.001842	0.363691159	1.40565159	0.000702826
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.00446951	0.12988342	0.170648096	0.175718642	0.003300936	0	0.299049574	1.472403407	0.002764	0.204760161	0.007942252	0.334722414	0.002372235	0	0.0041461	0	0.000898	0.002213474	0.0041	0.809680397	3.129381915	0.001564691
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.00246935	0.07175902	0.094281013	0.097082428	0.001823727	0	0.165221279	0.813485108	0.0015271	0.113127517	0.004387998	0.184930093	0.001310631	0	0.0022907	0	0.000496	0.001222918	0.002265	0.447338645	1.728945731	0.000864473
	Travis	0.00050761	0.01475105	0.298194277	0.307054662	0.000374892	0	0.033779905	0.166319069	0.0003331	0.024678605	0.000901861	0.038008491	0.000269863	0	0.0004695	0	0.000103	0.000253624	0.000465	0.0918527	0.642918196	0.000321459
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22352453	6.49558905	0.00447587	0.004608863	0.165082827	0	0.007477478	0.036816183	0.001651	0.122307068	0.001597886	0.067342128	0.045960479	0	0.0071176	0	0.001581	0.003898589	0.008136	1.606684378	8.337246261	0.004168623
	San Patricio	0.05533089	1.60790722	0.001107949	0.00114087	0.040864326	0	0.001850962	0.009113416	0.0004087	0.030275687	0.000395538	0.016669757	0.01137698	0	0.0017619	0	0.000391	0.00096505	0.002014	0.397715956	2.063787957	0.001031894
Victoria Area	Victoria	0.02060475	0.59877099	0.002090584	0.002152702	0.015217528	0	0.003408874	0.016783968	0.0011319	0.083854042	0.000524055	0.022086044	0.495811308	0	0.0305841	0	0.00045	0.001109661	0.002128	0.420152343	1.144909752	0.000572455
Other ERCOT counties	Andrews	2.5653E-05	0.00074546	2.58716E-05	2.66404E-05	1.89456E-05	0	4.28342E-05	0.000210899	1.121E-05	0.000830685	3.69632E-06	0.00015578	3.65442E-05	0	0.000127	0	4.35E-05	0.00010717	0.000233	0.046085051	0.048161687	2.40808E-05
	Angelina	0.00032149	0.00934246	0.000324234	0.000333868	0.000237435	0	0.000536817	0.002643077	0.0001405	0.010410498	4.63239E-05	0.001952297	0.000457988	0	0.0015917	0	0.000545	0.001343101	0.002925	0.577557604	0.603582902	0.000301791
	Bosque	0.00093945	0.02730035	0.001730301	0.001781715	0.000693828	0	0.002769496	0.013635918	0.0011606	0.085978798	0.000334979	0.014117518	0.009007821	0	0.0360555	0	0.00037	0.000912335	0.001684	0.332530047	0.476256684	0.000238128
	Brazos	0.00191393	0.05561841	0.003525105	0.003629848	0.00141352	0	0.005642234	0.027780157	0.0023645	0.175162719	0.000682445	0.028761309	0.018351436	0	0.073455	0	0.000754	0.001858681	0.003431	0.677456172	0.970267297	0.000485134
	Calhoun	0.08852525	2.57253032	0.001772635	0.001825307	0.065379841	0	0.0029614	0.014580779	0.0006539	0.048438816	0.000632831	0.026670355	0.01820231	0	0.0028189	0	0.000626	0.001544008	0.003222	0.636315543	3.301905128	0.001650953
	Cameron	0.05467229	1.58876844	0.001094762	0.001127291	0.285623104	0	0.001828931	0.00900494	0.0004038	0.029915318	0.00039083	0.016471339	0.011241561	0	0.0017409	0	0.000387	0.000953563	0.00199	0.392981979	2.039222874	0.001019611
	Cherokee	0.003513	0.10208711	0.003542982	0.003648256	0.002594504	0	0.005865919	0.028881497	0.0015356	0.11375785	0.000506191	0.021333183	0.005004538	0	0.0173929	0	0.005951	0.01467637	0.031959	6.31110147	6.595485735	0.003297743
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.0013551	0.03937898	2.71346E-05	2.79409E-05	0.001000801	0	4.53316E-05	0.000223195	1.001E-05	0.000741477	9.68705E-06	0.000408256	0.000278632	0	4.315E-05	0	9.58E-06	2.36349E-05	4.93E-05	0.009740394	0.050543881	2.52719E-05
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.00362926	0.10546585	0.003660242	0.003769001	0.002680373	0	0.006060061	0.029837378	0.0015864	0.117522856	0.000522944	0.02203924	0.005170172	0	0.0179686	0	0.006148	0.015162109	0.033017	6.519977905	6.813774343	0.003406887
	Fannin	0.00762852	0.22168353	0.007693632	0.007922236	0.005633999	0	0.012737922	0.062716559	0.0033346	0.247026702	0.001099201	0.046325293	0.010867422	0	0.0377689	0	0.012923	0.031869936	0.0694	13.70464171	14.32218597	0.007161093
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.00377443	0.10968449	0.003806652	0.003919761	0.002787588	0	0.006302464	0.031030873	0.0016499	0.12222377	0.000543862	0.02292081	0.005376978	0	0.0186873	0	0.006394	0.015768594	0.034338	6.780777021	7.086325316	0.003543163
	Frio	0.01476384	0.42903492	0.001497957	0.001542467	0.010903753	0	0.002442547	0.012026147	0.0008111	0.060083591	0.000375499	0.015825222	0.355261637	0	0.0219143	0	0.000322	0.000795101	0.001525	0.30105003	0.820357475	0.000410179
	Grimes	0.00055442	0.01611148	0.001021149	0.001051491	0.000409467	0	0.001634436	0.008047327	0.0006849	0.050740957	0.00019769	0.008331547	0.005316025	0	0.0212784	0	0.000218	0.000538421	0.000994	0.196244809	0.281066035	0.000140533
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.239737	6.96672099	0.004800509	0.004943149	0.177056459	0	0.008019827	0.0394865	0.0017708	0.131178129	0.001713782	0.072226524	0.049294041	0	0.0076338	0	0.001695	0.004181358	0.008726	1.723218895	8.941955549	0.004470978
	Howard	0.00058508	0.01700236	0.000590075	0.000607608	0.000432108	0	0.000976955	0.004810144	0.0002558	0.018946096	8.43049E-05	0.00355299	0.000833494	0	0.0028967	0	0.000991	0.002444314	0.005323	1.051098725	1.098462239	0.000549231
	Jack	0.00217756	0.06327951	0.002196145	0.002261401	0.001608224	0	0.003636037	0.017902427	0.0009519	0.070513714	0.000313767	0.013223544	0.003102103	0	0.0107811	0	0.003689	0.009097266	0.01981	3.911986743	4.088264606	0.002044132
	Jones	0.04250012	1.2350472	0.000851025	0.000876312	0.031388236	0	0.00142174	0.007000092	0.0003139	0.023255012	0.000303816	0.012804182	0.008738755	0	0.0013533	0	0.000301	0.000741263	0.001547	0.305489005	1.585213062	0.000792607
	Lamar	0.00107998	0.03138407	0.001089199	0.001121563	0.000797614	0	0.001803327	0.008878877	0.0004721	0.03497194	0.000155616	0.006558341	0.001538517	0	0.005347	0	0.00183	0.004511875	0.009825	1.94018666	2.027613326	0.001013807
	Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Llano	0.00124346	0.03613476	0.047475864	0.048886536	0.000918351	0	0.083198331	0.409636117	0.000769	0.056966153	0.002209607	0.093122842	0.000659977	0	0.0011535	0	0.00025	0.000615809	0.001141	0.225260504	0.870622718	0.000435311
	McLennan	0.02303137	0.6692881	0.023227961	0.023918144	0.017009692	0	0.038457253	0.189348509	0.0100675	0.745802046	0.003318614	0.139861392	0.032809997	0	0.1140288	0	0.039015	0.096219005	0.209526	41.37589079	43.24032799	0.021620164
	Milam	0.00165249	0.04802117	0.001666598	0.001716118	0.001220439	0	0.002759294	0.013585685	0.0007223	0.053511019	0.000238109	0.010035003	0.002354105	0	0.0081815	0	0.002799	0.006903678	0.015033	2.96870474	3.102477414	0.001551239
	Mitchell	0.01696145	0.49289727	0.017106233	0.017614519	0.012526789	0	0.028321847	0.139445724	0.0074142	0.549245973	0.002443993	0.103000932	0.024162925	0	0.0839765	0	0.028733	0.070860493	0.154305	30.47127789	31.8443428	0.015922171
	Nolan	0.00060327	0.01753102	0.000608422	0.000626501	0.000445544	0	0.001007331	0.004959706	0.0002637	0.01953519	8.69262E-05	0.003663464	0.00085941	0	0.0029868	0	0.001022	0.002520316	0.005488	1.083780729	1.132616924	0.000566308
	Palo Pinto	0.00307488	0.08935553	0.00566337	0.005831648	0.002270935	0	0.00906471	0.044631095	0.0037988	0.281413244	0.001096403	0.046207397	0.029483083	0	0.1180115	0	0.001211	0.002986123	0.005512	1.088388783	1.558813821	0.000779407
	Pecos	4.2262E-05	0.00122812	4.26225E-05	4.3889E-05	3.12122E-05	0	7.05678E-05	0.000347448	1.847E-05	0.001368522	6.08954E-06	0.000256641	6.02052E-05	0	0.0002092	0	7.16E-05	0.000176559	0.000384	0.075923359	0.079344538	3.96723E-05
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.00035926	0.01043997	0.000406685	0.000418769	0.000265328	0	0.000358385	0.00176455	0.0015339	0.113628648	0.00035593	0.015000506	0.000370532	0	0.0009089	0	0.093323	0.230151898	0.001655	0.326754003	0.698158342	0.000349079
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tom Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upton	3.2238E-05	0.00093683	3.25131E-05	3.34792E-05	2.38092E-05	0	5.38302E-05	0.000265039	1.409E-05	0.00104393	4.6452E-06	0.00019577	4.59255E-05	0	0.0001596	0	5.46E-05	0.000134682	0.000293	0.05791553	0.060525259	3.02626E-05
	Ward	0.01980763	0.57560662	0.0199767	0.020570277	0.014628815	0	0.033074321	0.162845052	0.0086584	0.64141077	0.002854101	0.120284737	0.028217522	0	0.098068	0	0.033554	0.082751055	0.180198	35.58443168	37.18790019	0.01859395
	Webb	0.01418005	0.41206999	0.000283942	0.000292379	0.010472596	0	0.000474359	0.002335561	0.0001047	0.007758969	0.000101367	0.004272079	0.002915661	0	0.0004515	0	0.0001	0.00024732	0.000516	0.101925539	0.528901838	0.000264451
	Wharton	0.00015439	0.00448655	0.000191235	0.000196918	0.000114024	0	6.43902E-05	0.000317032	0.0011702	0.086684748	0.000265844	0.011203851	0.000106811	0	6.777E-05	0	8.17E-05	0.00020153	0.000112	0.022161203	0.125251831	6.26259E-05
	Wichita	0.00021984	0.0063886	0.000221719	0.000228308	0.000162364	0	0.000367089	0.001807402	9.61E-05	0.007118957	3.16774E-05	0.001335029	0.000313184	0	0.0010884	0	0.000372	0.000918446	0.002	0.394948206	0.41274495	0.000206372
	Wilbarger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wise	0.00291847	0.08481033	0.002955932	0.003043763	0.002155421	0	0.004892446	0.024088495	0.0012878	0.095396583	0.000423725	0.017857705	0.004280539	0	0.0149528	0	0.004924	0.012144313	0.026441	5.221313004	5.458654189	0.002729327
	Young	0.00549666	0.15973212	0.005543579	0.005708298	0.004059529	0	0.009178198	0.045189864	0.0024027	0.177992915	0.000792019	0.033379282	0.007830425	0	0.0272141	0	0.009311	0.022963602	0.050005	9.874758944	10.31972502	0.005159863
	Total	**1.14303735**	**33.2164934**	**1.154658244**	**1.188967139**	**1.089429227**	**0**	**1.180868675**	**5.814136562**	**1.5393506**	**114.0348967**	**1.443965054**	**60.85521919**	**1.48172714**	**0**	**1.2697054**	**0**	**1.151969**	**2.840955914**	**1.517783**	**299.722395**	**517.673064**	**0.258836532**
Energy Savings by PCA (MWh)		29.06		1.03		0.00		4.92		74.08		42.14		0.00		0.00		2.47		197.47			

Table 59: 2010 Annual and OSD NOx Reductions from the 90.1-1999 for Commercial Buildings by County using 2007 eGRID (w/7% T&D) (1)

	Electricity Savings and Resultant NOx Reductions (Office)				Total Natural Gas Savings and Resultant NOx Reductions (Office)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
HARRIS	6,364.77	4.07	56.08	0.03	(126,152.41)	(0.58)	2,040.2133	0.0094	3.49	0.0408
TARRANT	5,479.22	1.80	37.25	0.01	(59,566.62)	(0.27)	1,084.5248	0.0050	1.52	0.0196
COLLIN	5,364.78	0.09	29.46	0.00	(34,863.73)	(0.16)	617.2667	0.0028	(0.07)	0.0034
DALLAS	4,373.06	0.66	36.35	0.00	(82,112.16)	(0.38)	1,234.0985	0.0057	0.28	0.0102
BEXAR	6,304.29	4.27	36.95	0.02	(39,419.45)	(0.18)	957.9633	0.0044	4.09	0.0278
TRAVIS	3,273.24	0.06	18.98	0.00	(15,976.54)	(0.07)	447.8557	0.0021	(0.02)	0.0024
DENTON	2,548.74	0.02	16.60	0.00	(29,244.88)	(0.13)	506.8846	0.0023	(0.12)	0.0025
WILLIAMSON	1,549.60	0.00	8.35	0.00	(10,646.90)	(0.05)	183.4041	0.0008	(0.05)	0.0008
EL PASO	730.98	0.00	9.20	0.00	(27,871.28)	(0.13)	428.3613	0.0020	(0.13)	0.0020
MONTGOMERY	2,179.97	0.00	11.97	0.00	(14,838.59)	(0.07)	257.5907	0.0012	(0.07)	0.0012
GALVESTON	1,067.06	2.23	5.70	0.01	(6,018.20)	(0.03)	115.5423	0.0005	2.20	0.0130
BRAZORIA	1,149.37	0.57	6.26	0.00	(9,686.20)	(0.04)	146.3996	0.0007	0.53	0.0048
COMAL	465.37	0.00	2.48	0.00	(2,922.68)	(0.01)	55.6054	0.0003	(0.01)	0.0003
ROCKWALL	470.71	0.00	2.50	0.00	(3,850.90)	(0.02)	55.0408	0.0003	(0.02)	0.0003
HAYS	843.73	0.15	4.53	0.00	(6,128.38)	(0.03)	99.6230	0.0005	0.12	0.0013
NUECES	563.49	0.69	3.60	0.00	(3,802.42)	(0.02)	111.9558	0.0005	0.67	0.0047
FORT BEND	1,842.29	4.20	11.59	0.02	(20,053.04)	(0.09)	306.0918	0.0014	4.11	0.0240
ELLIS	(242.80)	0.48	0.23	0.00	(5,790.88)	(0.03)	70.3569	0.0003	0.46	0.0036
JOHNSON	191.18	0.01	1.23	0.00	(3,065.49)	(0.01)	39.1093	0.0002	(0.00)	0.0003
GUADALUPE	199.95	0.12	1.69	0.00	(4,173.12)	(0.02)	60.9884	0.0003	0.10	0.0010
KAUFMAN	105.93	0.93	0.88	0.01	(2,978.21)	(0.01)	38.3237	0.0002	0.92	0.0063
JEFFERSON	945.30	0.00	5.26	0.00	(1,832.05)	(0.01)	122.7066	0.0006	(0.01)	0.0006
PARKER	391.05	0.01	2.00	0.00	(2,089.06)	(0.01)	42.7254	0.0002	(0.00)	0.0003
SMITH	446.30	0.00	3.07	0.00	(4,091.05)	(0.02)	94.8573	0.0004	(0.02)	0.0004
BASTROP	140.26	0.27	0.78	0.00	(258.29)	(0.00)	22.2030	0.0001	0.27	0.0017
CHAMBERS	89.87	1.30	0.44	0.01	(707.16)	(0.00)	9.3559	0.0000	1.29	0.0089
GREGG	237.31	0.00	1.50	0.00	(983.54)	(0.00)	45.6052	0.0002	(0.00)	0.0002
SAN PATRICIO	(269.26)	0.15	(0.18)	0.00	(3,815.23)	(0.02)	42.3554	0.0002	0.14	0.0012
LIBERTY	281.73	0.00	1.38	0.00	(2,444.75)	(0.01)	35.4456	0.0002	(0.01)	0.0002
VICTORIA	146.48	0.10	0.80	0.00	(719.04)	(0.00)	17.0053	0.0001	0.09	0.0007
ORANGE	207.00	0.00	1.10	0.00	(1,694.57)	(0.01)	30.1311	0.0001	(0.01)	0.0001
CALDWELL	91.24	0.00	0.50	0.00	(955.45)	(0.00)	14.7111	0.0001	(0.00)	0.0001
WILSON	52.55	0.00	0.27	0.00	(229.66)	(0.00)	7.3226	0.0000	(0.00)	0.0000
HARDIN	96.97	0.00	0.47	0.00	(757.38)	(0.00)	10.4174	0.0000	(0.00)	0.0000
HARRISON	250.89	0.00	1.34	0.00	(1,463.49)	(0.01)	34.4608	0.0002	(0.01)	0.0002
WALLER	(9.12)	0.00	0.02	0.00	(349.04)	(0.00)	4.1497	0.0000	(0.00)	0.0000
UPSHUR	71.32	0.00	0.36	0.00	(628.50)	(0.00)	9.7221	0.0000	(0.00)	0.0000
RUSK	36.41	0.10	0.19	0.00	(234.82)	(0.00)	3.0692	0.0000	0.10	0.0000
HOOD	194.12	1.85	0.97	0.01	(1,516.58)	(0.01)	24.7175	0.0001	1.84	0.0117
HUNT	180.05	0.91	0.95	0.01	(1,482.58)	(0.01)	25.1534	0.0001	0.91	0.0061
HENDERSON	23.79	0.12	0.20	0.00	(596.83)	(0.00)	8.0105	0.0000	0.12	0.0009
HIDALGO	0.00	0.57	0.00	0.00	0.00	0.00	0.0000	0.0000	0.57	0.0045
CAMERON	869.30	0.15	5.95	0.00	(9,058.64)	(0.04)	188.0215	0.0009	0.11	0.0019
BELL	1,142.84		6.63		(3,500.49)	(0.02)	166.2135	0.0008	(0.02)	0.0008
WEBB	475.24	0.06	2.99	0.00	(4,793.57)	(0.02)	95.4114	0.0004	0.04	0.0007
BRAZOS	1,257.66	0.08	6.75	0.00	(6,038.87)	(0.03)	164.5281	0.0008	0.05	0.0012
KENDALL	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
BURNET	118.40		0.60		(817.79)	(0.00)	14.7725	0.0001	(0.00)	0.0001
GRAYSON	171.83		1.31		(2,921.80)	(0.01)	48.2176	0.0002	(0.01)	0.0002
CORYELL	138.91		0.74		(797.22)	(0.00)	16.9898	0.0001	(0.00)	0.0001
MIDLAND	542.85		2.86		(3,007.75)	(0.01)	61.7977	0.0003	(0.01)	0.0003
LLANO	154.63	0.07	0.84	0.00	258.16	0.00	17.7269	0.0001	0.08	0.0005
MAVERICK	166.13		0.86		(594.67)	(0.00)	19.2372	0.0001	(0.00)	0.0001
MCMULLEN	4.75		0.02		(47.70)	(0.00)	0.7804	0.0000	(0.00)	0.0000
ARANSAS	94.26		0.48		(322.84)	(0.00)	6.3511	0.0000	(0.00)	0.0000
WICHITA	604.08	0.03	3.36	0.00	(860.96)	(0.00)	74.3694	0.0003	0.03	0.0005
TAYLOR	348.40	0.00	2.05	0.00	(2,039.52)	(0.01)	46.9692	0.0002	(0.01)	0.0002
TOM GREEN	531.44	0.00	2.94	0.00	(1,993.03)	(0.01)	69.8041	0.0003	(0.00)	0.0003
MCLENNAN	716.71	3.63	4.25	0.02	(5,732.60)	(0.03)	119.1497	0.0005	3.60	0.0222
MCCULLOCH	12.71		0.06		(128.25)	(0.00)	1.8157	0.0000	(0.00)	0.0000
WISE	230.64	0.42	1.20	0.00	(783.05)	(0.00)	29.7724	0.0001	0.42	0.0029
JIM HOGG	13.20		0.07		(103.68)	(0.00)	1.8182	0.0000	(0.00)	0.0000
VAL VERDE	83.12		0.44		(556.17)	(0.00)	11.0468	0.0001	(0.00)	0.0001
ECTOR	36.41	0.52	1.37	0.00	(2,976.83)	(0.01)	75.5946	0.0003	0.51	0.0038
WHARTON	104.22	0.01	0.58	0.00	(749.43)	(0.00)	11.7001	0.0001	0.01	0.0001
KERR	316.10		1.64		(1,117.78)	(0.01)	37.2239	0.0002	(0.01)	0.0002
PRESIDIO	10.07	0.00	0.05	0.00	(111.05)	(0.00)	1.6685	0.0000	(0.00)	0.0000
JIM WELLS	159.19		0.83		(654.11)	(0.00)	16.8164	0.0001	(0.00)	0.0001
CALHOUN	65.08	0.25	0.32	0.00	(339.08)	(0.00)	4.5336	0.0000	0.25	0.0017
GILLESPIE	57.61		0.32		(330.36)	(0.00)	6.8808	0.0000	(0.00)	0.0000
MATAGORDA	54.56		0.31		(429.55)	(0.00)	8.8432	0.0000	(0.00)	0.0000
NAVARRO	42.57		0.38		(831.30)	(0.00)	14.2773	0.0001	(0.00)	0.0001
ANGELINA	297.83	0.05	1.55	0.00	(1,563.52)	(0.01)	32.6956	0.0002	0.04	0.0005
NACOGDOCHES	266.10		1.40		(1,955.59)	(0.01)	37.2371	0.0002	(0.01)	0.0002
FANNIN	42.40	1.04	0.23	0.01	(401.49)	(0.00)	7.0140	0.0000	1.04	0.0072
ATASCOSA	92.07		0.48		(531.79)	(0.00)	10.8745	0.0001	(0.00)	0.0001
WASHINGTON	156.73		0.91		(1,510.26)	(0.01)	24.3865	0.0001	(0.01)	0.0001
LAMAR	57.89	0.14	0.29	0.00	(487.28)	(0.00)	7.5558	0.0000	0.14	0.0010
VAN ZANDT	54.15		0.26		(546.83)	(0.00)	7.7830	0.0000	(0.00)	0.0000
WILLACY	114.07		0.59		(926.25)	(0.00)	12.2181	0.0001	(0.00)	0.0001
BROWN	61.93		0.35		(309.46)	(0.00)	8.6414	0.0000	(0.00)	0.0000
ERATH	66.38		0.34		(434.57)	(0.00)	9.0519	0.0000	(0.00)	0.0000
AUSTIN	(390.53)		(1.02)		(2,364.49)	(0.01)	22.5802	0.0001	(0.01)	0.0001
COOKE	370.05		2.01		(1,439.19)	(0.01)	43.4710	0.0002	(0.01)	0.0002
MEDINA	32.18		0.16		(331.43)	(0.00)	4.7642	0.0000	(0.00)	0.0000
TITUS	58.91	0.84	0.29	0.00	(482.46)	(0.00)	6.7923	0.0000	0.84	0.0000
UVALDE	147.69		0.77		(1,067.38)	(0.00)	15.9190	0.0001	(0.00)	0.0001
FAYETTE	60.82	0.00	0.32	0.00	(101.09)	(0.00)	7.1002	0.0000	(0.00)	0.0000
CALLAHAN	24.93		0.13		(289.08)	(0.00)	4.1038	0.0000	(0.00)	0.0000
HOPKINS	41.69		0.27		(480.26)	(0.00)	7.9627	0.0000	(0.00)	0.0000
LAMPASAS	61.17		0.31		(215.24)	(0.00)	5.2426	0.0000	(0.00)	0.0000
BLANCO	22.50		0.11		(227.09)	(0.00)	3.1854	0.0000	(0.00)	0.0000
FREESTONE	11.54	0.54	0.06	0.00	(100.65)	(0.00)	1.5995	0.0000	0.54	0.0036
GRIMES	15.01	0.00	0.07	0.00	(151.15)	(0.00)	2.2690	0.0000	(0.00)	0.0002
LEE	19.22		0.09		(195.36)	(0.00)	2.7102	0.0000	(0.00)	0.0000
SOMERVELL	8.57		0.05		(94.88)	(0.00)	1.5048	0.0000	(0.00)	0.0000
ANDREWS	14.87	0.00	0.08	0.00	(52.97)	(0.00)	1.9120	0.0000	0.00	0.0000
BORDEN	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000

Table 60: 2010 Annual and OSD NOx Reductions from the 90.1-1999 for Commercial Buildings by County using 2007 eGRID (w/7% T&D) (2)

	Electricity Savings and Resultant NOx Reductions (Office)				Total Natural Gas Savings and Resultant NOx Reductions (Office)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
CHEROKEE	142.54	0.52	0.90	0.00	(1,547.94)	(0.01)	31.1095	0.0001	0.51	0.0034
DIMMIT	3.30		0.02		(33.28)	(0.00)	0.4658	0.0000	(0.00)	0.0000
FALLS	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
COLORADO	29.94		0.15		(180.94)	(0.00)	3.9411	0.0000	(0.00)	0.0000
FRIO	35.78	0.04	0.18	0.00	(226.18)	(0.00)	3.9418	0.0000	0.04	0.0004
MILAM	80.45	0.33	0.39	0.00	(654.82)	(0.00)	8.9810	0.0000	0.33	0.0016
JACKSON	23.53		0.11		(238.20)	(0.00)	3.3656	0.0000	(0.00)	0.0000
ANDERSON	9.93		0.06		(53.65)	(0.00)	1.2800	0.0000	(0.00)	0.0000
HILL	94.92		0.47		(751.70)	(0.00)	11.6207	0.0001	(0.00)	0.0001
CULBERSON	12.74		0.06		(122.62)	(0.00)	1.7390	0.0000	(0.00)	0.0000
MASON	1.40		0.01		(14.15)	(0.00)	0.1980	0.0000	(0.00)	0.0000
PECOS	35.26	0.01	0.19	0.00	(43.89)	(0.00)	4.3556	0.0000	0.01	0.0001
RAINS	11.27		0.05		(113.66)	(0.00)	1.6221	0.0000	(0.00)	0.0000
LAVACA	17.43		0.09		(147.61)	(0.00)	2.7190	0.0000	(0.00)	0.0000
PALO PINTO	81.78	0.13	0.41	0.00	(559.59)	(0.00)	8.4726	0.0000	0.12	0.0008
KIMBLE	3.27		0.02		(32.81)	(0.00)	0.5427	0.0000	(0.00)	0.0000
MADISON	13.45		0.07		(137.12)	(0.00)	1.9408	0.0000	(0.00)	0.0000
ARCHER	27.95		0.15		(219.01)	(0.00)	4.5461	0.0000	(0.00)	0.0000
REFUGIO	2.94		0.01		(29.53)	(0.00)	0.4695	0.0000	(0.00)	0.0000
LIMESTONE	42.97	0.04	0.22	0.00	(191.05)	(0.00)	3.8181	0.0000	0.04	0.0000
CLAY	4.85		0.02		(48.94)	(0.00)	0.7043	0.0000	(0.00)	0.0000
BEE	157.10		0.80		(814.84)	(0.00)	20.2548	0.0001	(0.00)	0.0001
MARTIN	0.57		0.00		(5.71)	(0.00)	0.0798	0.0000	(0.00)	0.0000
GONZALES	11.71		0.06		(52.67)	(0.00)	1.3354	0.0000	(0.00)	0.0000
BURLESON	23.78		0.12		(152.26)	(0.00)	3.1040	0.0000	(0.00)	0.0000
KARNES	11.83		0.06		(72.20)	(0.00)	1.5391	0.0000	(0.00)	0.0000
KLEBERG	162.28		0.81		(885.16)	(0.00)	14.6575	0.0001	(0.00)	0.0001
BREWSTER	21.07		0.14		(212.07)	(0.00)	5.0098	0.0000	(0.00)	0.0000
WINKLER	1.87		0.01		(18.77)	(0.00)	0.3078	0.0000	(0.00)	0.0000
FRANKLIN	(60.37)		(0.17)		(265.58)	(0.00)	2.1303	0.0000	(0.00)	0.0000
YOUNG	114.75	0.92	0.58	0.01	(649.34)	(0.00)	11.1089	0.0001	0.92	0.0052
HOUSTON	71.75		0.37		(229.47)	(0.00)	5.3631	0.0000	(0.00)	0.0000
SCURRY	(9.87)		0.01		(150.12)	(0.00)	2.1370	0.0000	(0.00)	0.0000
BOSQUE	22.05	0.02	0.11	0.00	(222.43)	(0.00)	3.1612	0.0000	0.02	0.0003
COMANCHE	214.95		1.17		120.32	0.00	25.7620	0.0001	0.00	0.0001
BRISCOE	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
CONCHO	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
ZAVALA	8.11		0.04		(50.20)	(0.00)	1.1488	0.0000	(0.00)	0.0000
NOLAN	76.87	0.08	0.39	0.00	(355.33)	(0.00)	7.9234	0.0000	0.08	0.0006
BROOKS	1.96		0.01		(6.94)	(0.00)	0.1526	0.0000	(0.00)	0.0000
ROBERTSON	6.46	0.12	0.04	0.00	(60.83)	(0.00)	1.3647	0.0000	0.12	0.0004
LIVE OAK	18.89		0.10		(189.33)	(0.00)	3.1874	0.0000	(0.00)	0.0000
HAMILTON	15.81		0.08		(43.85)	(0.00)	1.9854	0.0000	(0.00)	0.0000
JONES	16.51	0.12	0.10	0.00	(292.11)	(0.00)	4.2667	0.0000	0.12	0.0008
REAGAN	3.35		0.02		(22.11)	(0.00)	0.5182	0.0000	(0.00)	0.0000
WARD	(0.16)	2.74	(0.00)	0.02	(0.67)	(0.00)	0.0051	0.0000	2.74	0.0186
RED RIVER	20.43	0.00	0.10	0.00	(204.99)	(0.00)	2.9510	0.0000	(0.00)	0.0000
HASKELL	23.54	0.00	0.12	0.00	(100.50)	(0.00)	1.1324	0.0000	(0.00)	0.0000
HOWARD	34.92	0.08	0.18	0.00	(162.60)	(0.00)	4.4691	0.0000	0.08	0.0006
SAN SABA	13.10		0.07		(120.10)	(0.00)	1.8775	0.0000	(0.00)	0.0000
JACK	3.51	0.31	0.02	0.00	(35.30)	(0.00)	0.5599	0.0000	0.31	0.0020
STEPHENS	10.06		0.05		(64.44)	(0.00)	1.3366	0.0000	(0.00)	0.0000
RUNNELS	9.67		0.05		(85.37)	(0.00)	1.1696	0.0000	(0.00)	0.0000
REEVES	21.45		0.11		(77.51)	(0.00)	2.8505	0.0000	(0.00)	0.0000
DE WITT	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
CHILDRESS	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
CROSBY	3.07		0.02		(8.69)	(0.00)	0.4184	0.0000	(0.00)	0.0000
DAWSON	9.20		0.04		(92.82)	(0.00)	1.3196	0.0000	(0.00)	0.0000
MITCHELL	18.59	2.21	0.10	0.02	(17.13)	(0.00)	2.3714	0.0000	2.21	0.0159
WILBARGER	58.43	0.09	0.31	0.00	(141.37)	(0.00)	5.9603	0.0000	0.09	0.0000
COLEMAN	5.38	0.00	0.03	0.00	(29.20)	(0.00)	0.7142	0.0000	0.00	0.0000
UPTON	0.30	0.00	0.00	0.00	1.40	0.00	0.0321	0.0000	0.00	0.0000
COKE	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.00	0.0000
CROCKETT	7.47	0.00	0.04	0.00	(75.01)	(0.00)	1.2045	0.0000	(0.00)	0.0000
HARDEMAN	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.00	0.0000
BANDERA	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
BAYLOR	6.42		0.03		5.68	0.00	0.7453	0.0000	0.00	0.0000
COTTLE	1.92		0.01		(19.40)	(0.00)	0.2715	0.0000	(0.00)	0.0000
CRANE	4.55		0.02		(45.77)	(0.00)	0.7180	0.0000	(0.00)	0.0000
DELTA	3.74		0.02		(37.73)	(0.00)	0.5398	0.0000	(0.00)	0.0000
DICKENS	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
DUVAL	28.49		0.14		(271.94)	(0.00)	3.8267	0.0000	(0.00)	0.0000
EASTLAND	72.55		0.36		(395.74)	(0.00)	5.4903	0.0000	(0.00)	0.0000
EDWARDS	0.87		0.00		(8.72)	(0.00)	0.1299	0.0000	(0.00)	0.0000
FISHER	8.67		0.04		(22.68)	(0.00)	1.0766	0.0000	(0.00)	0.0000
FOARD	0.32		0.00		(3.23)	(0.00)	0.0543	0.0000	(0.00)	0.0000
GLASSCOCK	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
GOLIAD	5.51		0.03		(55.64)	(0.00)	0.7787	0.0000	(0.00)	0.0000
HALL	0.68		0.00		(6.85)	(0.00)	0.0958	0.0000	(0.00)	0.0000
HUDSPETH	12.13		0.06		(122.36)	(0.00)	1.7459	0.0000	(0.00)	0.0000
IRION	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
JEFF DAVIS	11.69		0.06		(117.17)	(0.00)	1.9674	0.0000	(0.00)	0.0000
KENEDY	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
KENT	5.26		0.03		24.68	0.00	0.5656	0.0000	0.00	0.0000
KING	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
KINNEY	5.07		0.02		(44.15)	(0.00)	0.6034	0.0000	(0.00)	0.0000
KNOX	3.13		0.02		(31.44)	(0.00)	0.4840	0.0000	(0.00)	0.0000
LA SALLE	5.94		0.03		(4.90)	(0.00)	0.6259	0.0000	(0.00)	0.0000
LEON	20.75		0.10		(210.45)	(0.00)	3.2963	0.0000	(0.00)	0.0000
LOVING	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
MENARD	2.62		0.01		(18.86)	(0.00)	0.3694	0.0000	(0.00)	0.0000
MILLS	13.08		0.06		(131.80)	(0.00)	1.9292	0.0000	(0.00)	0.0000
MONTAGUE	56.19		0.29		(239.42)	(0.00)	5.3501	0.0000	(0.00)	0.0000
MOTLEY	0.80		0.00		(8.10)	(0.00)	0.1134	0.0000	(0.00)	0.0000
REAL	8.59		0.05		17.96	0.00	1.1277	0.0000	0.00	0.0000
SCHLEICHER	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
SHACKELFORD	13.06		0.07		(59.51)	(0.00)	1.7701	0.0000	(0.00)	0.0000
STARR	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
STERLING	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
STONEWALL	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
SUTTON	4.58		0.02		(9.46)	(0.00)	0.5625	0.0000	(0.00)	0.0000
TERRELL	0.00		0.00		0.00	0.00	0.0000	0.0000	0.00	0.0000
THROCKMORTON	1.85		0.01		(18.56)	(0.00)	0.3125	0.0000	(0.00)	0.0000
ZAPATA	60.01		0.29		(548.18)	(0.00)	8.2846	0.0000	(0.00)	0.0000
TOTAL	**60,824.84**	**41.35**	**394.99**	**0.26**	**(617,226.62)**	**(2.84)**	**11,365.77**	**0.05**	**38.51**	**0.31**



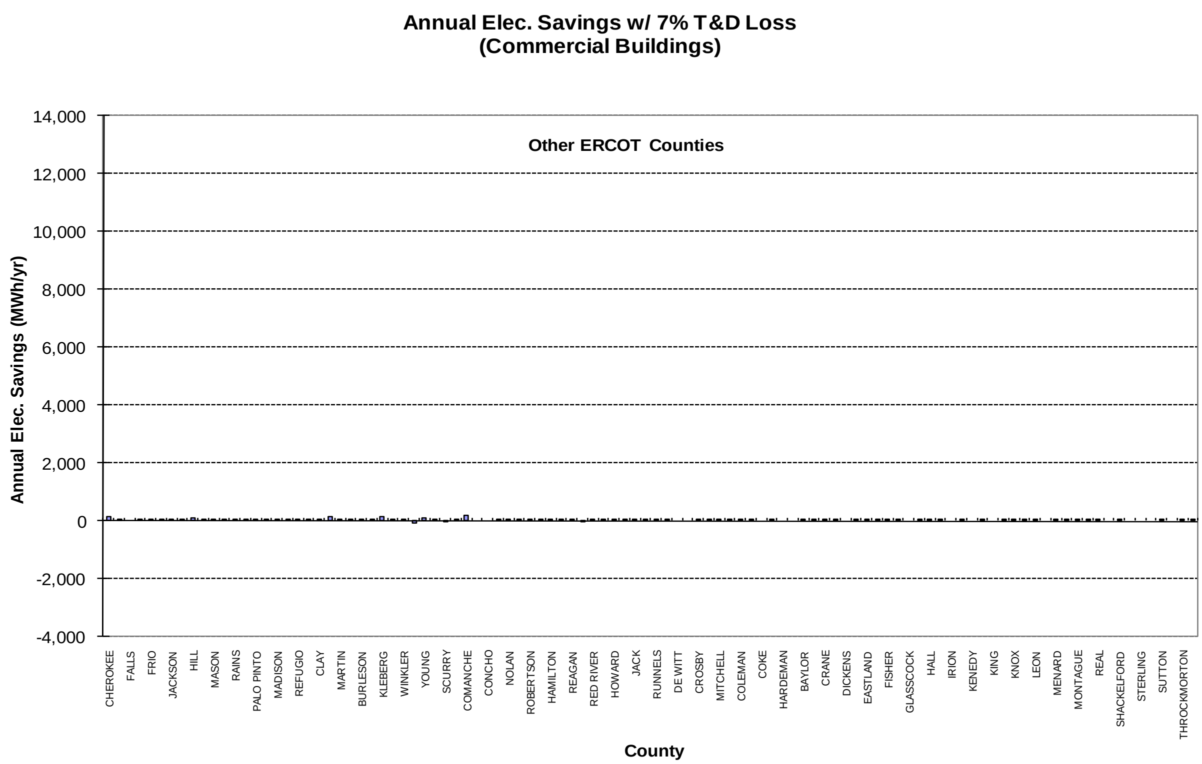
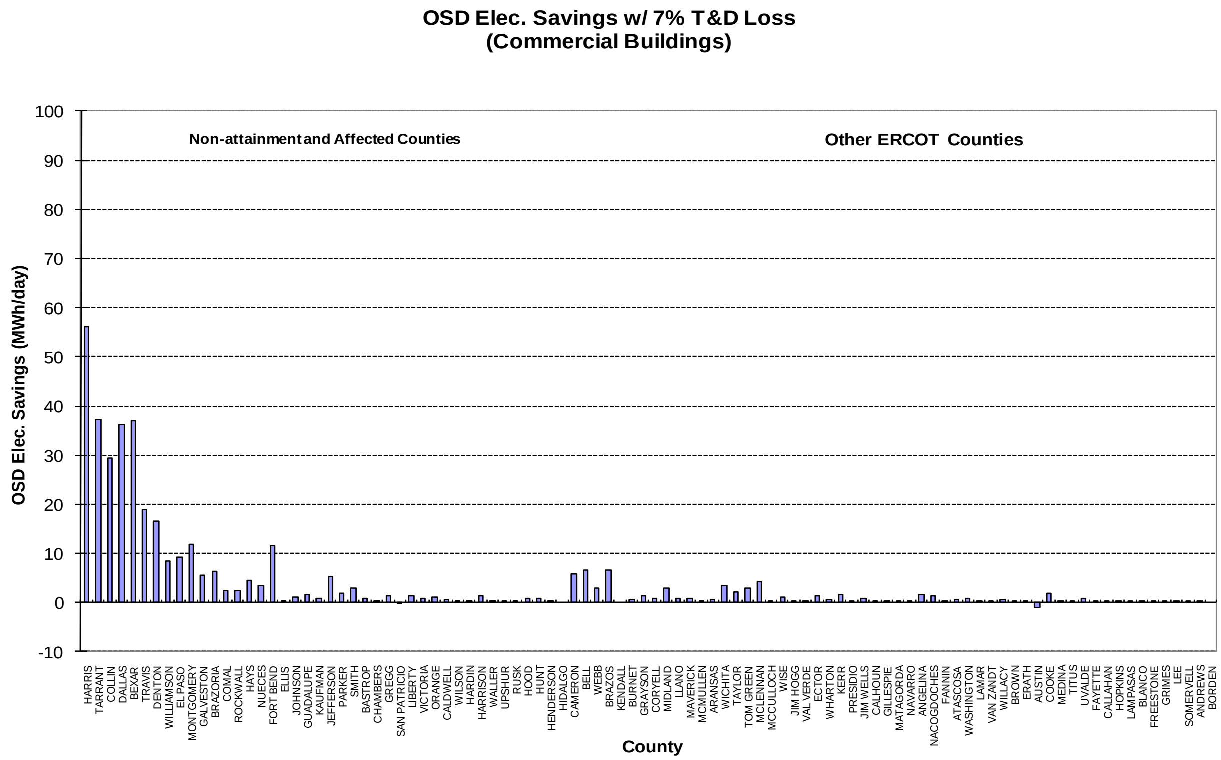


Figure 158: 2010 Annual Electricity Reductions from the 90.1-1999 for Commercial Buildings with 7% T&D losses



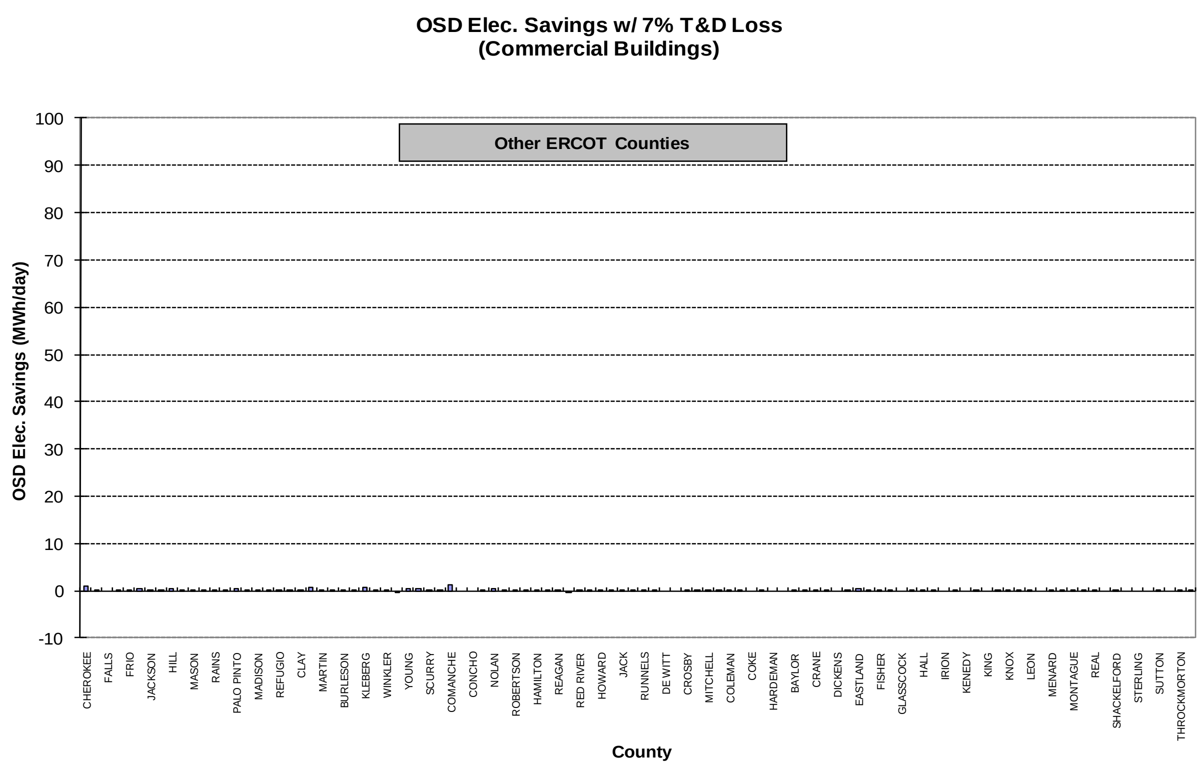
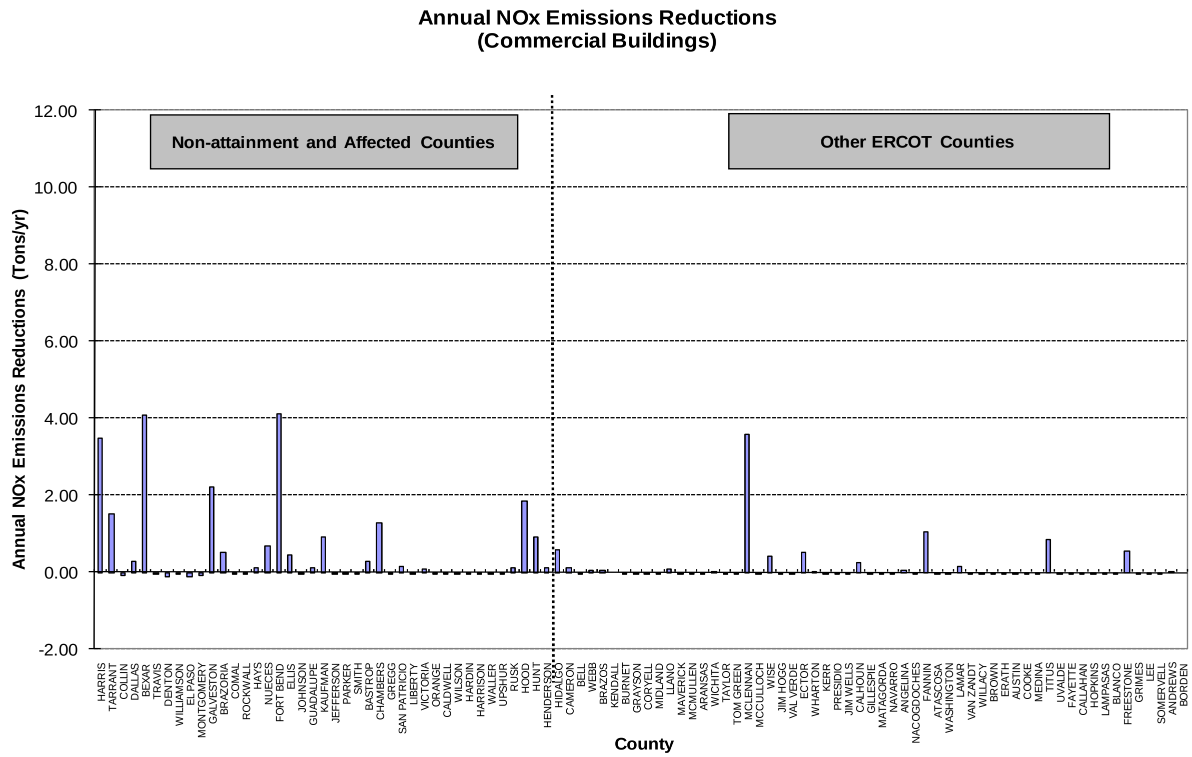


Figure 159: 2010 OSD Electricity Reductions from the 90.1-1999 for Commercial Buildings with 7% T&D losses



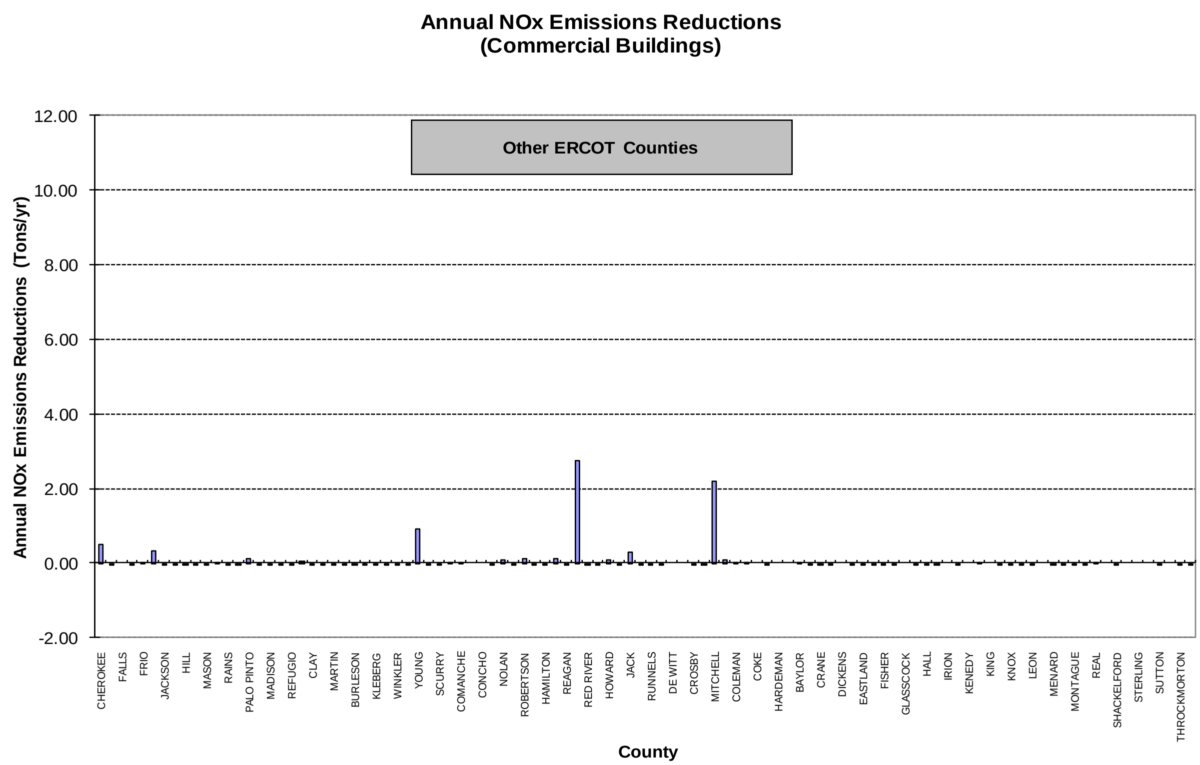
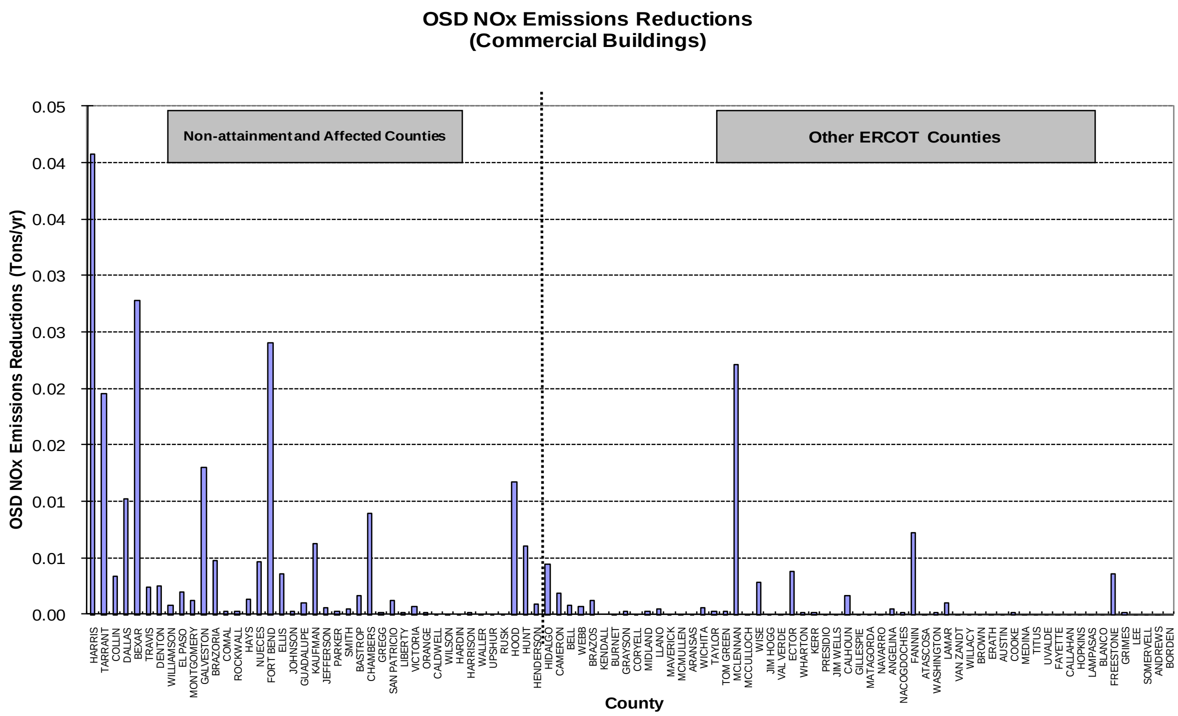


Figure 160: 2010 Annual NOx Reductions from Electricity Savings from the 90.1-1999 for Commercial Buildings by County using 2007 eGRID with 7% T&D losses



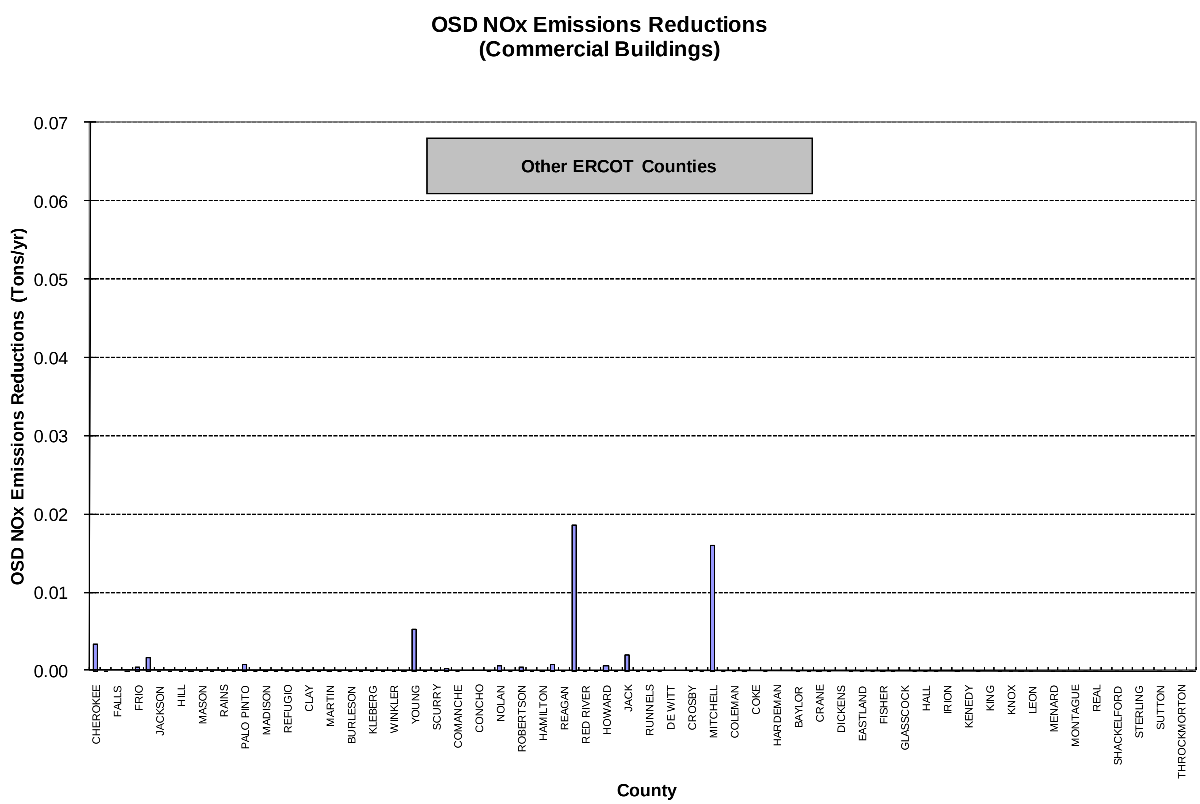


Figure 161: 2010 Annual NOx Reductions from Electricity Savings from the 90.1-1999 for Commercial Buildings by County using 2007 eGRID with 7% T&D losses

6.1.6 2010 Results for New Residential (Single-family and Multi-family), and Commercial Construction Using 2007 eGRID.

As shown in Table 61 and Table 62, the total annual electricity savings in 2010 were calculated to be 371,241.32 MWh/yr [1] which includes 123,882.94 MWh/yr (i.e., 33.4%) for single-family residential, 186,533.54 MWh/yr (i.e., 50.2%) for multi-family residential, and 60,824.84 MWh/yr (i.e., 16.4%) for new commercial buildings. Natural gas savings were calculated to be 128,573.44 MMBtu (1,285,734.35 therms) for new residential and commercial construction.

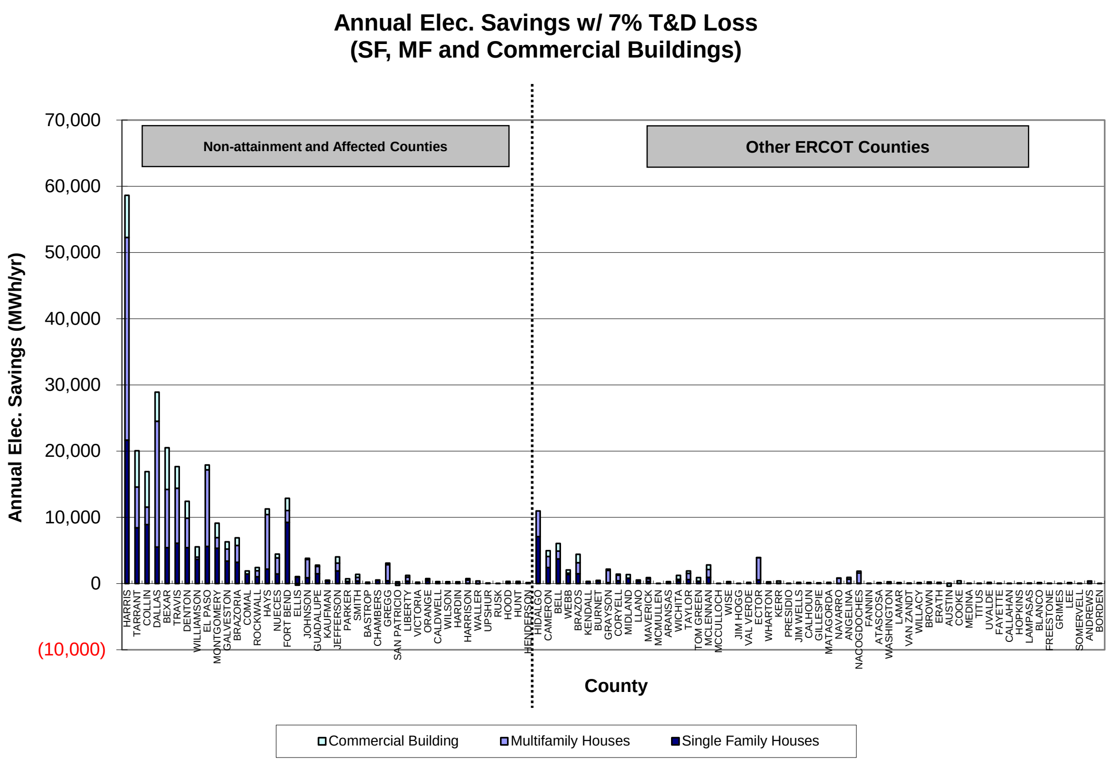
Using the 2007 eGRID, the total NOx reductions from electricity and natural gas savings from new residential (single-family and multi-family) and commercial construction in 2010 were calculated to be 161.38 tons NOx/year which represents 155.47 tons NOx/year from electricity savings and 5.91 tons NOx/year from natural gas savings. On a peak Ozone Season Day (OSD), the NOx reductions in 2010 are calculated to be 0.99 tons of NOx/day which represents 0.93 tons NOx/day from electricity savings and 0.06 tons NOx/day from natural gas savings.

Table 61: 2010 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County (using 2007 eGRID) (Part 1)

	Electricity Savings and Resultant NOx Reductions (Single Family Houses)				Electricity Savings and Resultant NOx Reductions (Multifamily Houses)				Electricity Savings and Resultant NOx Reductions (Commercial Buildings)				Total Electricity Savings and Resultant NOx Reductions (SF, MF and Commecial Buildings)				Total Natural Gas Savings and Resultant NOx Reductions (SF, MF and Commercial Buildings)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
HARRIS	21,663.68	13.51	122.48	0.09	30,603.28	1.40	148.09	0.01	6,364.77	4.07	56.08	0.03	58,631.73	18.98	326.65	0.13	81,849.98	0.38	2,156.98	0.01	19.36	0.14
TARRANT	8,436.19	3.85	51.95	0.03	6,142.89	0.46	33.35	0.00	5,479.22	1.80	37.25	0.01	20,058.30	6.11	122.54	0.05	4,076.70	0.02	1,117.21	0.01	6.13	0.05
COLLIN	8,897.03	0.21	53.62	0.00	2,653.96	0.02	14.14	0.00	5,364.78	0.09	29.46	0.00	16,915.77	0.32	97.22	0.00	26,279.91	0.12	649.70	0.00	0.44	0.00
DALLAS	5,503.70	1.41	33.89	0.01	19,017.99	0.17	103.25	0.00	4,373.06	0.66	36.35	0.00	28,894.75	2.23	173.49	0.02	9,880.49	0.05	1,255.42	0.01	2.28	0.02
BEXAR	5,412.25	6.67	31.86	0.04	8,789.74	0.94	46.39	0.01	6,304.29	4.27	36.95	0.02	20,506.28	11.88	115.20	0.07	6,485.43	0.03	982.47	0.00	11.91	0.07
TRAVIS	6,101.39	0.16	37.00	0.00	8,283.36	0.02	44.37	0.00	3,273.24	0.06	18.98	0.00	17,657.99	0.23	100.35	0.00	16,487.76	0.08	472.27	0.00	0.31	0.00
DENTON	5,414.86	0.05	32.62	0.00	4,464.80	0.01	23.79	0.00	2,548.74	0.02	16.60	0.00	12,428.40	0.07	73.01	0.00	22,838.23	0.11	526.85	0.00	0.18	0.00
WILLIAMSON	3,670.55	0.00	22.26	0.00	316.31	0.00	1.69	0.00	1,549.60	0.00	8.35	0.00	5,536.46	0.00	32.31	0.00	1,207.04	0.01	198.09	0.00	0.01	0.00
EL PASO	5,618.43	0.00	23.80	0.00	11,563.55	0.00	41.40	0.00	730.98	0.00	9.20	0.00	17,912.96	0.00	74.41	0.00	57,094.88	0.26	451.39	0.00	0.26	0.00
MONTGOMERY	5,335.10	0.00	30.16	0.00	1,606.25	0.00	7.77	0.00	2,179.97	0.00	11.97	0.00	9,121.32	0.00	49.91	0.00	20,358.35	0.09	286.35	0.00	0.09	0.00
GALVESTON	3,384.38	7.04	19.13	0.03	1,840.66	0.74	8.90	0.00	1,067.06	2.23	5.70	0.01	6,292.11	10.00	33.74	0.05	18,034.38	0.08	133.82	0.00	10.08	0.05
BRAZORIA	3,220.15	1.82	18.20	0.01	2,546.25	0.19	12.32	0.00	1,149.37	0.57	6.26	0.00	6,915.77	2.58	36.79	0.02	15,346.77	0.07	163.79	0.00	2.65	0.02
COMAL	1,453.11	0.00	8.56	0.00	0.00	0.00	0.00	0.00	465.37	0.00	2.48	0.00	1,918.49	0.00	11.03	0.00	3,524.91	0.02	62.18	0.00	0.02	0.00
ROCKWALL	1,031.10	0.00	6.21	0.00	909.09	0.00	4.84	0.00	470.71	0.00	2.50	0.00	2,410.90	0.00	13.55	0.00	6,290.44	0.03	58.84	0.00	0.03	0.00
HAYS	2,195.72	0.43	13.32	0.00	8,237.23	0.04	44.12	0.00	843.73	0.15	4.53	0.00	11,276.69	0.62	61.97	0.00	14,200.40	0.07	108.41	0.00	0.69	0.00
NUECES	1,457.03	2.06	7.32	0.01	2,435.61	0.12	11.05	0.00	563.49	0.69	3.60	0.00	4,456.14	2.87	21.96	0.02	6,939.71	0.03	119.34	0.00	2.90	0.02
FORT BEND	9,255.61	13.94	52.33	0.06	1,767.64	1.45	8.55	0.01	1,842.29	4.20	11.59	0.02	12,865.54	19.59	72.47	0.09	38,254.54	0.18	355.98	0.00	19.76	0.10
ELLIS	977.50	1.04	6.02	0.01	69.33	0.12	0.38	0.00	-242.80	0.48	0.23	0.00	804.03	1.65	6.62	0.01	-576.75	-0.00	74.14	0.00	1.64	0.01
JOHNSON	877.14	0.03	5.40	0.00	2,752.51	0.00	14.94	0.00	191.18	0.01	1.23	0.00	3,820.83	0.04	21.57	0.00	10,659.39	0.05	42.51	0.00	0.09	0.00
GUADALUPE	1,490.90	0.35	8.78	0.00	1,094.33	0.04	5.78	0.00	199.95	0.12	1.69	0.00	2,785.18	0.51	16.24	0.00	5,167.48	0.02	67.74	0.00	0.53	0.00
KAUFMAN	394.31	2.00	2.38	0.01	14.66	0.24	0.08	0.00	105.93	0.93	0.88	0.01	514.90	3.18	3.34	0.02	-364.39	-0.00	39.78	0.00	3.17	0.02
JEFFERSON	1,898.74	0.00	10.59	0.00	1,181.02	0.00	5.66	0.00	945.30	0.00	5.26	0.00	4,025.06	0.00	21.50	0.00	11,532.76	0.05	132.83	0.00	0.05	0.00
PARKER	303.64	0.02	1.83	0.00	21.99	0.00	0.12	0.00	391.05	0.01	2.00	0.00	716.68	0.03	3.94	0.00	-35.64	-0.00	43.85	0.00	0.03	0.00
SMITH	406.94	0.00	2.47	0.00	537.67	0.00	2.76	0.00	446.30	0.00	3.07	0.00	1,390.92	0.00	8.29	0.00	2,769.69	0.01	96.98	0.00	0.01	0.00
BASTROP	59.43	0.79	0.37	0.00	13.14	0.08	0.07	0.00	140.26	0.27	0.78	0.00	212.84	1.14	1.22	0.01	18.07	0.00	22.53	0.00	1.14	0.01
CHAMBERS	445.31	4.31	2.49	0.03	0.00	0.45	0.00	0.00	89.87	1.30	0.44	0.01	535.17	6.05	2.93	0.04	1,752.90	0.01	11.74	0.00	6.06	0.04
GREGG	420.48	0.00	2.54	0.00	2,437.27	0.00	12.45	0.00	237.31	0.00	1.50	0.00	3,095.05	0.00	16.48	0.00	16,238.57	0.07	47.70	0.00	0.07	0.00
SAN PATRICIO	262.64	0.46	1.32	0.00	0.00	0.03	0.00	0.00	-269.26	0.15	-0.18	0.00	-6.61	0.64	1.13	0.00	-2,670.29	-0.01	43.69	0.00	0.62	0.00
LIBERTY	379.61	0.00	2.14	0.00	586.22	0.00	2.83	0.00	281.73	0.00	1.38	0.00	1,247.56	0.00	6.36	0.00	1,306.55	0.01	37.48	0.00	0.01	0.00
VICTORIA	79.98	0.27	0.46	0.00	0.00	0.02	0.00	0.00	146.48	0.10	0.80	0.00	226.46	0.39	1.26	0.00	-118.75	-0.00	17.50	0.00	0.39	0.00
ORANGE	415.57	0.00	2.32	0.00	124.25	0.00	0.59	0.00	207.00	0.00	1.10	0.00	746.81	0.00	4.01	0.00	899.59	0.00	32.35	0.00	0.00	0.00
CALDWELL	19.38	0.00	0.12	0.00	190.57	0.00	0.00	0.00	91.24	0.00	0.50	0.00	301.18	0.00	0.62	0.00	-895.44	-0.00	14.79	0.00	-0.00	0.00
WILSON	53.25	0.00	0.31	0.00	175.56	0.00	0.93	0.00	52.55	0.00	0.27	0.00	281.36	0.00	1.51	0.00	443.83	0.00	7.56	0.00	0.00	0.00
HARDIN	172.08	0.00	0.96	0.00	0.00	0.00	0.00	0.00	96.97	0.00	0.47	0.00	269.06	0.00	1.43	0.00	189.63	0.00	11.34	0.00	0.00	0.00
HARRISON	75.62	0.00	0.45	0.00	441.13	0.00	2.25	0.00	250.89	0.00	1.34	0.00	767.64	0.00	4.04	0.00	1,761.92	0.01	34.84	0.00	0.01	0.00
WALLER	17.63	0.00	0.10	0.00	384.27	0.00	1.86	0.00	-9.12	0.00	0.02	0.00	392.79	0.00	1.98	0.00	791.49	0.00	4.24	0.00	0.00	0.00
UPSHUR	30.37	0.00	0.19	0.00	0.00	0.00	0.00	0.00	71.32	0.00	0.36	0.00	101.69	0.00	0.55	0.00	-307.85	-0.00	9.88	0.00	-0.00	0.00
RUSK	0.00	0.22	0.00	0.00	0.00	0.03	0.00	0.00	36.41	0.10	0.19	0.00	36.41	0.34	0.19	0.00	-234.82	-0.00	3.07	0.00	0.34	0.00
HOOD	154.55	3.96	0.95	0.02	0.00	0.48	0.00	0.00	194.12	1.85	0.97	0.01	348.67	6.29	1.92	0.04	-729.03	-0.00	25.32	0.00	6.29	0.04
HUNT	78.58	1.96	0.47	0.01	72.98	0.24	0.39	0.00	180.05	0.91	0.95	0.01	331.61	3.11	1.81	0.02	-751.17	-0.00	25.44	0.00	3.10	0.02
HENDERSON	119.66	0.26	0.73	0.00	0.00	0.03	0.00	0.00	23.79	0.12	0.20	0.00	143.45	0.41	0.92	0.00	841.69	0.00	8.64	0.00	0.42	0.00
HIDALGO	7,091.64	1.71	35.51	0.01	3,880.57	0.10	17.97	0.00	0.00	0.57	0.00	0.00	10,972.21	2.38	53.48	0.02	35,195.72	0.16	32.75	0.00	2.54	0.02
CAMERON	2,428.68	0.44	12.16	0.00	1,667.96	0.03	7.72	0.00	869.30	0.15	5.95	0.00	4,965.93	0.61	25.83	0.00	3,498.02	0.02	199.24	0.00	0.63	0.00
BELL	3,715.30		21.29		1,206.48		6.17		1,142.84	0.00	6.63	0.00	6,064.63	0.00	34.09	0.00	19,875.33	0.09	179.82	0.00	0.09	0.00
WEBB	1,366.26	0.18	6.82	0.00	219.20	0.01	0.99	0.00	475.24	0.06	2.99	0.00	2,060.70	0.25	10.80	0.00	-998.14	-0.00	100.36	0.00	0.25	0.00
BRAZOS	1,489.05	0.19	8.42	0.00	1,675.42	0.02	8.11	0.00	1,257.66	0.08	6.75	0.00	4,422.12	0.29	23.28	0.00	7,101.15	0.03	172.55	0.00	0.32	0.00
KENDALL	345.14		2.03		0.00		0.00		0.00	0.00	0.00	0.00	345.14	0.00	2.03	0.00	1,575.69	0.01	1.57	0.00	0.01	0.00
BURNET	367.25		2.23		0.00		0.00		118.40	0.00	0.60	0.00	485.65	0.00	2.83	0.00	316.18	0.00	16.24	0.00	0.00	0.00
GRAYSON	159.29		0.96		1,838.97		9.80		171.83	0.00	1.31	0.00	2,170.09	0.00	12.07	0.00	5,012.42	0.02	48.80	0.00	0.02	0.00
CORYELL	411.87		2.36		875.44		4.48		138.91	0.00	0.74	0.00	1,426.21	0.00	7.58	0.00	4,264.12	0.02	18.50	0.00	0.02	0.00
MIDLAND	825.36		3.13		0.00		0.00		542.85	0.00	2.86	0.00	1,368.21	0.00	5.98	0.00	4,433.19	0.02	64.86	0.00	0.02	0.00
LLANO	378.91	0.22	2.30	0.00	13.18	0.02	0.07	0.00	154.63	0.07	0.84	0.00	546.72	0.31	3.21	0.00	1,449.81	0.01	19.24	0.00	0.32	0.00
MAVERICK	335.12		1.67		397.82		1.80		166.13	0.00	0.86	0.00	899.07	0.00	4.34	0.00	956.47	0.00	20.45	0.00	0.00	0.00
MCMULLEN	0.00		0.00		0.00		0.00		4.75	0.00	0.02	0.00	4.75	0.00	0.02	0.00	-47.70	-0.00	0.78	0.00	-0.00	0.00
ARANSAS	208.45		1.05		0.00		0.00		94.26	0.00	0.48	0.00	302.70	0.00	1.52	0.00	585.84	0.00	7.41	0.00	0.00	0.00
WICHITA	383.46	0.07	1.68	0.00	268.93	0.01	1.12	0.00	604.08	0.03	3.36	0.00	1,256.47	0.10	6.16	0.00	4,195.36	0.02	75.50	0.00	0.12	0.00
TAYLOR	612.15	0.00	2.66	0.00	942.63	0.00	3.77	0.00	348.40	0.00	2.05	0.00	1,903.17	0.00	8.49	0.00	7,934.44	0.04	49.07	0.00	0.04	0.00
TOM GREEN	367.67	0.01	1.65	0.00	0.00	0.00	0.00	0.00	531.44	0.00	2.94	0.00	899.11	0.02	4.59	0.00	426.06	0.00	71.18	0.00	0.02	0.00
MCLENNAN	938.38	7.76	5.38	0.04	1,177.06	0.93	6.02	0.01	716.71	3.63	4.25	0.02	2,832.14	12.32	15.65	0.07	3,076.51	0.01	122.59	0.00	12.34	0.07
MCCULLOCH	0.00		0.00		0.00		0.00		12.71	0.00	0.06	0.00	12.71	0.00	0.06	0.00	-128.25	-0.00	1.82	0.00	-0.00	0.00
WISE	66.13	0.90	0.40	0.01	0.00	0.11	0.00	0.00	230.64	0.42	1.20	0.00	296.76	1.42	1.60	0.01	-403.51	-0.00	30.01	0.00	1.42	0.01
JIM HOGG	0.00		0.00		0.00		0.00		13.20	0.00	0.07	0.00	13.20	0.00	0.07	0.00	-103.68	-0.00	1.82	0.00	-0.00	0.00
VAL VERDE	51.53		0.30		46.82		0.25		83.12	0.00	0.44	0.00	181.47	0.00	0.99	0.00	-210.94	-0.00	11.28	0.00	-0.00	0.00
ECTOR	561.41	1.12	2.13	0.01	3,341.28	0.13	11.73	0.00	36.41	0.52	1.37	0.00	3,939.10	1.78	15.23	0.01	19,452.89	0.09	77.68	0.00	1.87	0.01
WHARTON	103.80	0.03	0.60	0.00	53.67	0.00	0.27	0.00	104.22	0.01	0.58	0.00	261.69	0.04	1.44	0.00	204.77	0.00	12.34	0.00	0.04	0.00
KERR	79.67		0.48		0.00		0.00		316.10	0.00	1.64	0.00	395.77	0.00	2.13	0.00	-871.79	-0.00	37.54	0.00	-0.00	0.00
PRESIDIO	4.15	0.00	0.02	0.00	0.00	0.00	0.00	0.00	10.07	0.00	0.05	0.00	14.23	0.00	0.07	0.00	-83.72	-0.00	1.68	0.00	-0.00	0.00
JIM WELLS	37.52		0.19		0.00		0.00		159.19	0.00	0.83	0.00	196.71	0.00	1.02	0.00	-490.55	-0.00	17.01	0.00	-0.00	0.00
CALHOUN	95.29	0.75	0.55	0.00	0.00	0.04	0.00	0.00	65.08	0.25	0.32	0.00	160.38	1.04	0.87	0.01	376.16	0.00	5.13	0.00	1.05	0.01
GILLESPIE	66.07		0.40		0.00		0.00		57.61	0.00	0.32	0.00	123.68	0.00	0.72	0.00	-126.37	-0.00	7.15	0.00	-0.00	0.00
MATAGORDA	115.71		0.67		0.00		0.00		54.56	0.00	0.31	0.00	170.27	0.00	0.97	0.00	438.96	0.00	9.56	0.00	0.00	0.00
NAVARRO	21.23		0.12		794.51		4.06		42.57	0.00	0.38	0.00	858.32	0.00	4.57	0.00	1,925.20	0.01	14.36	0.00	0.01	0.00
ANGELINA	74.01	0.10	0.42	0.00	581.89	0.01	2.67	0.00	297.83	0.05	1.55	0.00	953.72	0.16	4.64	0.00	2,486.01	0.01	33.15	0.00	0.17	0.00
NACOGDOCHES	65.40		0.37		1,542.00		7.09		266.10	0.00	1.40	0.00	1,873.50	0.00	8.86	0.00	7,293.30	0.03	37.64	0.00	0.03	0.00
FANNIN	2.12	2.23	0.01	0.01	0.00	0.27	0.00	0.00	42.40	1.04	0.23	0.01	44.52	3.54	0.25	0.02	-389.24	-0.00	7.02	0.00	3.54	0.02
ATASCOSA	57.88		0.34		11.67		0.06		92.07	0.00	0.48	0.00	161.62	0.00	0.88	0.00	-242.74	-0.00	11.14	0.00	-0.00	0.00
WASHINGTON	105.80		0.60		0.00		0.00		156.73	0.00	0.91	0.00	262.53	0.00	1.51	0.00	-898.36	-0.00	24.96	0.00	-0.00	0.00
LAMAR	96.21	0.30	0.58	0.00	0.00	0.04	0.00	0.00	57.89	0.14	0.29	0.00	154.10	0.48	0.87	0.00	730.00	0.00	8.04	0.00	0.48	0.00
VAN ZANDT	10.67		0.06		29.33		0.16		54.15	0.00	0.26	0.00	94.14	0.00	0.48	0.00	-374.26	-0.00	7.82	0.00	-0.00	0.00
WILLACY	36.59		0.18		0.00		0.00		114.07	0.00	0.59	0.00	150.66	0.00	0.78	0.00	-774.37	-0.00	12.39	0.00	-0.00	0.00
BROWN	146.49		0.84		29.43		0.15		61.93	0.00	0.35	0.00	237.84	0.00	1.34	0.00	551.79	0.00	9.18	0.00	0.00	0.00
ERATH	102.02		0.44		0.00		0.00		66.38	0.00	0.34	0.00	168.40	0.00	0.79	0.00	439.27	0.00	9.40	0.00	0.00	0.00
AUSTIN	35.27		0.20		23.06		0.11		-390.53	0.00	-1.02	0.00	-332.21	0.00	-0.71	0.00	-2,098.21	-0.01	22.77	0.00	-0.01	0.00
COOKE	55.22		0.33		0.00		0.00		370.05	0.00	2.01	0.00	425.27	0.00	2.34	0.00	-1,120.87	-0.01	43.67	0.00	-0.01	0.00
MEDINA	20.61		0.12		0.00		0.00		32.18	0.00	0.16	0.00	52.79	0.00	0.28	0.00	-239.97	-0.00	4.86	0.00	-0.00	0.00
TITUS	8.37	1.80	0.05	0.00	0.00	0.22	0.00	0.00	58.91	0.84	0.29	0.00	67.28	2.86	0.34	0.00	-376.61	-0.00	6.83	0.00	2.86	0.00
UVALDE	17.18		0.10		11.70		0.06		147.69	0.00	0.77	0.00	176.57	0.00	0.94	0.00	-962.02	-0.00	16.00	0.00	-0.00	0.00
FAYETTE	9.80	0.00	0.06	0.00	0.00	0.00	0.00	0.00	60.82	0.00	0.32	0.00	70.61	0.00	0.38	0.00	-44.43	-0.00	7.15	0.00	-0.00	0.00
CALLAHAN	4.53		0.02		0.00		0.00		24.93	0.00	0.13	0.00	29.46	0.00	0.15	0.00	-250.24	-0.00	4.12	0.00	-0.00	0.00
HOPKINS	21.33		0.13		43.99		0.23		41.69	0.00	0.27	0.00	107.01	0.00	0.63	0.00	-190.80	-0.00	8.04	0.00	-0.00	0.00
LAMPASAS	29.72		0.17		0.00		0.00		61.17	0.00	0.31	0.00	90.89	0.00	0.48	0.00	-60.38	-0.00	5.35	0.00	-0.00	0.00
BLANCO	9.72		0.06		105.44		0.56		22.50	0.00	0.11	0.00	137.65	0.00	0.73	0.00	-23.67	-0.00	3.22	0.00	-0.00	0.00
FREESTONE	19.11	1.16	0.11	0.01	0.00	0.14	0.00	0.00	11.54	0.54	0.06	0.00	30.64	1.85	0.17	0.01	-1.10	-0.00	1.67	0.00	1.85	0.01
GRIMES	5.88	0.00	0.03	0.00	0.00	0.00	0.00	0.00	15.01	0.00	0.07	0.00	20.89	0.00	0.11	0.00	-117.16	-0.00	2.30	0.00	-0.00	0.00
LEE	7.75		0.05		105.14		0.56		19.22	0.00	0.09	0.00	132.11	0.00	0.71	0.00	7.75	0.00	2.74	0.00	0.00	0.00
SOMERVELL	16.06		0.10		0.00		0.00		8.57	0.00	0.05	0.00	24.62	0.00	0.15	0.00	-13.06	-0.00	1.57	0.00	-0.00	0.00
ANDREWS	64.94	0.01	0.25	0.00	303.75	0.00	1.07	0.00	14.87	0.00	0.08	0.00	383.56	0.01	1.39	0.00	2,111.42	0.01	2.15	0.00	0.02	0.00
BORDEN	36.86		0.12		0.00		0.00		0.00	0.00	0.00	0.00	36.86	0.00	0.12	0.00	650.06	0.00	0.20	0.00	0.00	0.00

Table 62: 2010 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County (using 2007 eGRID) (Part 2)

	Electricity Savings and Resultant NOx Reductions (Single Family Houses)				Electricity Savings and Resultant NOx Reductions (Multifamily Houses)				Electricity Savings and Resultant NOx Reductions (Commercial Buildings)				Total Electricity Savings and Resultant NOx Reductions (SF, MF and Commecial Buildings)				Total Natural Gas Savings and Resultant NOx Reductions (SF, MF and Commecial Buildings)				Total Nox Reductions	
County	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual Electricity Savings per County w/ 7% T&D Loss (MWh/County)	Annual Nox Reductions (Tons)	OSD Electricity Savings per County w/ 7% T&D Loss (MWh/County)	OSD Nox Reductions (Tons)	Total Annual N.G. Savings (Therm/County)	Annual Nox Reductions (Tons)	Total OSD N.G. Savings (Therm/County)	OSD Nox Reductions (Tons)	Annual Nox Reductions (Tons)	OSD Nox Reductions (Tons)
CHEROKEE	27.54	1.11	0.16	0.01	101.83	0.13	0.47	0.00	142.54	0.52	0.90	0.00	271.91	1.76	1.52	0.01	-673.86	-0.00	31.28	0.00	1.76	0.01
DIMMIT	10.74		0.05		0.00		0.00		3.30	0.00	0.02	0.00	14.04	0.00	0.07	0.00	-6.55	-0.00	0.50	0.00	-0.00	0.00
FALLS	10.62		0.06		0.00		0.00		0.00	0.00	0.00	0.00	10.62	0.00	0.06	0.00	55.31	0.00	0.04	0.00	0.00	0.00
COLORADO	13.71		0.08		0.00		0.00		29.94	0.00	0.15	0.00	43.65	0.00	0.23	0.00	-101.62	-0.00	4.01	0.00	-0.00	0.00
FRIO	18.73	0.11	0.11	0.00	0.00	0.01	0.00	0.00	35.78	0.04	0.18	0.00	54.51	0.15	0.29	0.00	-141.98	-0.00	4.03	0.00	0.15	0.00
MILAM	5.93	0.71	0.03	0.00	0.00	0.09	0.00	0.00	80.45	0.33	0.39	0.00	86.38	1.13	0.42	0.01	-635.31	-0.00	9.00	0.00	1.12	0.01
JACKSON	20.42		0.12		0.00		0.00		23.53	0.00	0.11	0.00	43.95	0.00	0.23	0.00	-84.94	-0.00	3.49	0.00	-0.00	0.00
ANDERSON	27.54		0.16		0.00		0.00		9.93	0.00	0.06	0.00	37.47	0.00	0.21	0.00	258.64	0.00	1.45	0.00	0.00	0.00
HILL	19.11		0.11		0.00		0.00		94.92	0.00	0.47	0.00	114.03	0.00	0.57	0.00	-652.14	-0.00	11.69	0.00	-0.00	0.00
CULBERSON	5.63		0.02		0.00		0.00		12.74	0.00	0.06	0.00	18.37	0.00	0.09	0.00	-83.60	-0.00	1.76	0.00	-0.00	0.00
MASON	17.49		0.11		0.00		0.00		1.40	0.00	0.01	0.00	18.89	0.00	0.11	0.00	39.85	0.00	0.27	0.00	0.00	0.00
PECOS	12.46	0.01	0.06	0.00	0.00	0.00	0.00	0.00	35.26	0.01	0.19	0.00	47.73	0.02	0.24	0.00	38.11	0.00	4.40	0.00	0.02	0.00
RAINS	0.00		0.00		0.00		0.00		11.27	0.00	0.05	0.00	11.27	0.00	0.05	0.00	-113.66	-0.00	1.62	0.00	-0.00	0.00
LAVACA	15.30		0.09		0.00		0.00		17.43	0.00	0.09	0.00	32.73	0.00	0.18	0.00	-30.83	-0.00	2.81	0.00	-0.00	0.00
PALO PINTO	36.28	0.32	0.16	0.00	639.07	0.03	2.56	0.00	81.78	0.13	0.41	0.00	757.12	0.48	3.13	0.00	2,958.53	0.01	8.60	0.00	0.49	0.00
KIMBLE	2.08		0.01		0.00		0.00		3.27	0.00	0.02	0.00	5.35	0.00	0.03	0.00	-19.15	-0.00	0.55	0.00	-0.00	0.00
MADISON	37.23		0.21		0.00		0.00		13.45	0.00	0.07	0.00	50.67	0.00	0.28	0.00	78.18	0.00	2.14	0.00	0.00	0.00
ARCHER	31.73		0.14		0.00		0.00		27.95	0.00	0.15	0.00	59.68	0.00	0.29	0.00	75.40	0.00	4.64	0.00	0.00	0.00
REFUGIO	5.10		0.03		0.00		0.00		2.94	0.00	0.01	0.00	8.04	0.00	0.04	0.00	8.79	0.00	0.50	0.00	0.00	0.00
LIMESTONE	8.49	0.14	0.05	0.00	0.00	0.01	0.00	0.00	42.97	0.04	0.22	0.00	51.46	0.20	0.27	0.00	-146.80	-0.00	3.85	0.00	0.20	0.00
CLAY	0.00		0.00		0.00		0.00		4.85	0.00	0.02	0.00	4.85	0.00	0.02	0.00	-48.94	-0.00	0.70	0.00	-0.00	0.00
BEE	15.31		0.09		0.00		0.00		157.10	0.00	0.80	0.00	172.41	0.00	0.89	0.00	-699.89	-0.00	20.35	0.00	-0.00	0.00
MARTIN	18.85		0.07		0.00		0.00		0.57	0.00	0.00	0.00	19.42	0.00	0.07	0.00	164.26	0.00	0.15	0.00	0.00	0.00
GONZALES	1.72		0.01		0.00		0.00		11.71	0.00	0.06	0.00	13.43	0.00	0.07	0.00	-45.05	-0.00	1.34	0.00	-0.00	0.00
BURLESON	21.55		0.12		0.00		0.00		23.78	0.00	0.12	0.00	45.33	0.00	0.24	0.00	-27.61	-0.00	3.22	0.00	-0.00	0.00
KARNES	43.01		0.25		0.00		0.00		11.83	0.00	0.06	0.00	54.84	0.00	0.31	0.00	106.61	0.00	1.73	0.00	0.00	0.00
KLEBERG	39.18		0.20		0.00		0.00		162.28	0.00	0.81	0.00	201.46	0.00	1.01	0.00	-712.70	-0.00	14.86	0.00	-0.00	0.00
BREWSTER	37.39		0.17		0.00		0.00		21.07	0.00	0.14	0.00	58.46	0.00	0.30	0.00	33.94	0.00	5.15	0.00	0.00	0.00
WINKLER	2.09		0.01		0.00		0.00		1.87	0.00	0.01	0.00	3.97	0.00	0.02	0.00	0.11	0.00	0.32	0.00	0.00	0.00
FRANKLIN	4.27		0.03		0.00		0.00		-60.37	0.00	-0.17	0.00	-56.10	0.00	-0.15	0.00	-241.09	-0.00	2.15	0.00	-0.00	0.00
YOUNG	11.34	1.97	0.05	0.01	0.00	0.24	0.00	0.00	114.75	0.92	0.58	0.01	126.08	3.13	0.63	0.02	-552.25	-0.00	11.15	0.00	3.13	0.02
HOUSTON	3.44		0.02		0.00		0.00		71.75	0.00	0.37	0.00	75.19	0.00	0.38	0.00	-190.43	-0.00	5.38	0.00	-0.00	0.00
SCURRY	97.00		0.32		249.98		0.75		-9.87	0.00	0.01	0.00	337.10	0.00	1.08	0.00	3,418.24	0.02	2.67	0.00	0.02	0.00
BOSQUE	4.25	0.06	0.02	0.00	29.43	0.01	0.15	0.00	22.05	0.02	0.11	0.00	55.72	0.09	0.28	0.00	-102.31	-0.00	3.18	0.00	0.09	0.00
COMANCHE	2.12		0.01		0.00		0.00		214.95	0.00	1.17	0.00	217.07	0.00	1.18	0.00	131.38	0.00	25.77	0.00	0.00	0.00
BRISCOE	22.52		0.03		0.00		0.00		0.00	0.00	0.00	0.00	22.52	0.00	0.03	0.00	423.62	0.00	0.05	0.00	0.00	0.00
CONCHO	2.08		0.01		0.00		0.00		0.00	0.00	0.00	0.00	2.08	0.00	0.01	0.00	13.67	0.00	0.01	0.00	0.00	0.00
ZAVALA	8.59		0.04		0.00		0.00		8.11	0.00	0.04	0.00	16.70	0.00	0.08	0.00	-28.82	-0.00	1.18	0.00	-0.00	0.00
NOLAN	2.27	0.18	0.01	0.00	0.00	0.02	0.00	0.00	76.87	0.08	0.39	0.00	79.14	0.28	0.40	0.00	-335.91	-0.00	7.93	0.00	0.28	0.00
BROOKS	14.27		0.07		0.00		0.00		1.96	0.00	0.01	0.00	16.23	0.00	0.08	0.00	59.38	0.00	0.21	0.00	0.00	0.00
ROBERTSON	11.76	0.26	0.07	0.00	0.00	0.03	0.00	0.00	6.46	0.12	0.04	0.00	18.22	0.41	0.11	0.00	7.16	0.00	1.43	0.00	0.41	0.00
LIVE OAK	16.68		0.08		0.00		0.00		18.89	0.00	0.10	0.00	35.56	0.00	0.18	0.00	-116.63	-0.00	3.27	0.00	-0.00	0.00
HAMILTON	0.00		0.00		0.00		0.00		15.81	0.00	0.08	0.00	15.81	0.00	0.08	0.00	-43.85	-0.00	1.99	0.00	-0.00	0.00
JONES	0.00	0.37	0.00	0.00	0.00	0.02	0.00	0.00	16.51	0.12	0.10	0.00	16.51	0.51	0.10	0.00	-292.11	-0.00	4.27	0.00	0.51	0.00
REAGAN	0.00		0.00		0.00		0.00		3.35	0.00	0.02	0.00	3.35	0.00	0.02	0.00	-22.11	-0.00	0.52	0.00	-0.00	0.00
WARD	14.66	5.87	0.06	0.04	0.00	0.71	0.00	0.01	-0.16	2.74	-0.00	0.02	14.51	9.32	0.06	0.06	131.53	0.00	0.06	0.00	9.32	0.06
RED RIVER	23.01	0.00	0.14	0.00	0.00	0.00	0.00	0.00	20.43	0.00	0.10	0.00	43.44	0.00	0.24	0.00	86.10	0.00	3.07	0.00	0.00	0.00
HASKELL	4.53	0.00	0.02	0.00	0.00	0.00	0.00	0.00	23.54	0.00	0.12	0.00	28.08	0.00	0.14	0.00	-61.67	-0.00	1.15	0.00	-0.00	0.00
HOWARD	4.19	0.18	0.02	0.00	0.00	0.02	0.00	0.00	34.92	0.08	0.18	0.00	39.11	0.28	0.20	0.00	-124.83	-0.00	4.48	0.00	0.28	0.00
SAN SABA	0.00		0.00		0.00		0.00		13.10	0.00	0.07	0.00	13.10	0.00	0.07	0.00	-120.10	-0.00	1.88	0.00	-0.00	0.00
JACK	9.07	0.67	0.04	0.00	0.00	0.08	0.00	0.00	3.51	0.31	0.02	0.00	12.58	1.07	0.06	0.01	42.38	0.00	0.59	0.00	1.07	0.01
STEPHENS	6.80		0.03		0.00		0.00		10.06	0.00	0.05	0.00	16.86	0.00	0.08	0.00	-6.18	-0.00	1.36	0.00	-0.00	0.00
RUNNELS	2.08		0.01		0.00		0.00		9.67	0.00	0.05	0.00	11.75	0.00	0.06	0.00	-71.71	-0.00	1.18	0.00	-0.00	0.00
REEVES	2.09		0.01		0.00		0.00		21.45	0.00	0.11	0.00	23.55	0.00	0.12	0.00	-58.62	-0.00	2.86	0.00	-0.00	0.00
DE WITT	11.91		0.07		0.00		0.00		0.00	0.00	0.00	0.00	11.91	0.00	0.07	0.00	89.40	0.00	0.07	0.00	0.00	0.00
CHILDRESS	5.82		0.02		0.00		0.00		0.00	0.00	0.00	0.00	5.82	0.00	0.02	0.00	102.64	0.00	0.03	0.00	0.00	0.00
CROSBY	0.00		0.00		0.00		0.00		3.07	0.00	0.02	0.00	3.07	0.00	0.02	0.00	-8.69	-0.00	0.42	0.00	-0.00	0.00
DAWSON	4.38		0.01		0.00		0.00		9.20	0.00	0.04	0.00	13.58	0.00	0.06	0.00	-15.27	-0.00	1.34	0.00	-0.00	0.00
MITCHELL	2.27	4.73	0.01	0.03	0.00	0.57	0.00	0.00	18.59	2.21	0.10	0.02	20.85	7.50	0.11	0.05	2.29	0.00	2.38	0.00	7.50	0.05
WILBARGER	5.29	0.26	0.02	0.00	0.00	0.01	0.00	0.00	58.43	0.09	0.31	0.00	63.72	0.36	0.33	0.00	-92.31	-0.00	5.98	0.00	0.36	0.00
COLEMAN	2.14	0.01	0.01	0.00	0.00	0.00	0.00	0.00	5.38	0.00	0.03	0.00	7.52	0.02	0.04	0.00	-15.25	-0.00	0.72	0.00	0.02	0.00
UPTON	1.95	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	2.25	0.02	0.01	0.00	13.92	0.00	0.04	0.00	0.02	0.00
COKE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CROCKETT	39.47	0.00	0.18	0.00	0.00	0.00	0.00	0.00	7.47	0.00	0.04	0.00	46.94	0.00	0.21	0.00	184.66	0.00	1.35	0.00	0.00	0.00
HARDEMAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BANDERA	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BAYLOR	0.00		0.00		0.00		0.00		6.42	0.00	0.03	0.00	6.42	0.00	0.03	0.00	5.68	0.00	0.75	0.00	0.00	0.00
COTTLE	0.00		0.00		0.00		0.00		1.92	0.00	0.01	0.00	1.92	0.00	0.01	0.00	-19.40	-0.00	0.27	0.00	-0.00	0.00
CRANE	3.91		0.02		171.34		0.63		4.55	0.00	0.02	0.00	179.80	0.00	0.66	0.00	739.13	0.00	0.73	0.00	0.00	0.00
DELTA	6.40		0.04		0.00		0.00		3.74	0.00	0.02	0.00	10.14	0.00	0.06	0.00	-1.00	-0.00	0.56	0.00	-0.00	0.00
DICKENS	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DUVAL	0.00		0.00		0.00		0.00		28.49	0.00	0.14	0.00	28.49	0.00	0.14	0.00	-271.94	-0.00	3.83	0.00	-0.00	0.00
EASTLAND	2.27		0.01		0.00		0.00		72.55	0.00	0.36	0.00	74.82	0.00	0.37	0.00	-376.32	-0.00	5.50	0.00	-0.00	0.00
EDWARDS	0.00		0.00		0.00		0.00		0.87	0.00	0.00	0.00	0.87	0.00	0.00	0.00	-8.72	-0.00	0.13	0.00	-0.00	0.00
FISHER	0.00		0.00		0.00		0.00		8.67	0.00	0.04	0.00	8.67	0.00	0.04	0.00	-22.68	-0.00	1.08	0.00	-0.00	0.00
FOARD	0.00		0.00		0.00		0.00		0.32	0.00	0.00	0.00	0.32	0.00	0.00	0.00	-3.23	-0.00	0.05	0.00	-0.00	0.00
GLASSCOCK	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GOLIAD	0.00		0.00		0.00		0.00		5.51	0.00	0.03	0.00	5.51	0.00	0.03	0.00	-55.64	-0.00	0.78	0.00	-0.00	0.00
HALL	0.00		0.00		0.00		0.00		0.68	0.00	0.00	0.00	0.68	0.00	0.00	0.00	-6.85	-0.00	0.10	0.00	-0.00	0.00
HUDSPETH	0.00		0.00		0.00		0.00		12.13	0.00	0.06	0.00	12.13	0.00	0.06	0.00	-122.36	-0.00	1.75	0.00	-0.00	0.00
IRION	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JEFF DAVIS	0.00		0.00		0.00		0.00		11.69	0.00	0.06	0.00	11.69	0.00	0.06	0.00	-117.17	-0.00	1.97	0.00	-0.00	0.00
KENEDY	93.76		0.47		0.00		0.00		0.00	0.00	0.00	0.00	93.76	0.00	0.47	0.00	389.18	0.00	0.43	0.00	0.00	0.00
KENT	0.00		0.00		0.00		0.00		5.26	0.00	0.03	0.00	5.26	0.00	0.03	0.00	24.68	0.00	0.57	0.00	0.00	0.00
KING	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KINNEY	0.00		0.00		0.00		0.00		5.07	0.00	0.02	0.00	5.07	0.00	0.02	0.00	-44.15	-0.00	0.60	0.00	-0.00	0.00
KNOX	0.00		0.00		0.00		0.00		3.13	0.00	0.02	0.00	3.13	0.00	0.02	0.00	-31.44	-0.00	0.48	0.00	-0.00	0.00
LA SALLE	12.89		0.06		0.00		0.00		5.94	0.00	0.03	0.00	18.83	0.00	0.10	0.00	27.18	0.00	0.67	0.00	0.00	0.00
LEON	0.00		0.00		0.00		0.00		20.75	0.00	0.10	0.00	20.75	0.00	0.10	0.00	-210.45	-0.00	3.30	0.00	-0.00	0.00
LOVING	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MENARD	0.00		0.00		0.00		0.00		2.62	0.00	0.01	0.00	2.62	0.00	0.01	0.00	-18.86	-0.00	0.37	0.00	-0.00	0.00
MILLS	0.00		0.00		0.00		0.00		13.08	0.00	0.06	0.00	13.08	0.00	0.06	0.00	-131.86	-0.00	1.93	0.00	-0.00	0.00
MONTAGUE	0.00		0.00		0.00		0.00		56.19	0.00	0.29	0.00	56.19	0.00	0.29	0.00	-239.42	-0.00	5.35	0.00	-0.00	0.00
MOTLEY	0.00		0.00		0.00		0.00		0.80	0.00	0.00	0.00	0.80	0.00	0.00	0.00	-8.10	-0.00	0.11	0.00	-0.00	0.00
REAL	0.00		0.00		0.00		0.00		8.59	0.00	0.05	0.00	8.59	0.00	0.05	0.00	17.96	0.00	1.13	0.00	0.00	0.00
SCHLEICHER	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SHACKELFORD	0.00		0.00		0.00		0.00		13.06	0.00	0.07	0.00	13.06	0.00	0.07	0.00	-59.51	-0.00	1.77	0.00	-0.00	0.00
STARR	4.57		0.02		0.00		0.00		0.00	0.00	0.00	0.00	4.57	0.00	0.02	0.00	18.98	0.00	0.02	0.00	0.00	0.00
STERLING	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STONEWALL	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUTTON	0.00		0.00		0.00		0.00		4.58	0.00	0.02	0.00	4.58	0.00	0.02	0.00	-9.46	-0.00	0.56	0.00	-0.00	0.00
TERRELL	0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THROCKMORTON	0.00		0.00		0.00		0.00		1.85	0.00	0.01	0.00	1.85	0.00	0.01	0.00	-18.56	-0.00	0.31	0.00	-0.00	0.00
ZAPATA	0.00		0.00		0.00		0.00		60.01	0.00	0.29	0.00	60.01	0.00	0.29	0.00	-548.18	-0.00	8.28	0.00	-0.00	0.00
TOTAL	131,838.84	102.73	745.64	0.59	143,654.46	11.39	706.76	0.07	60,824.84	41.35	394.99	0.26	336,318.13	155.47	1,847.39	0.93	522,457.99	2.40	11,964.64	0.06	157.88	0.98



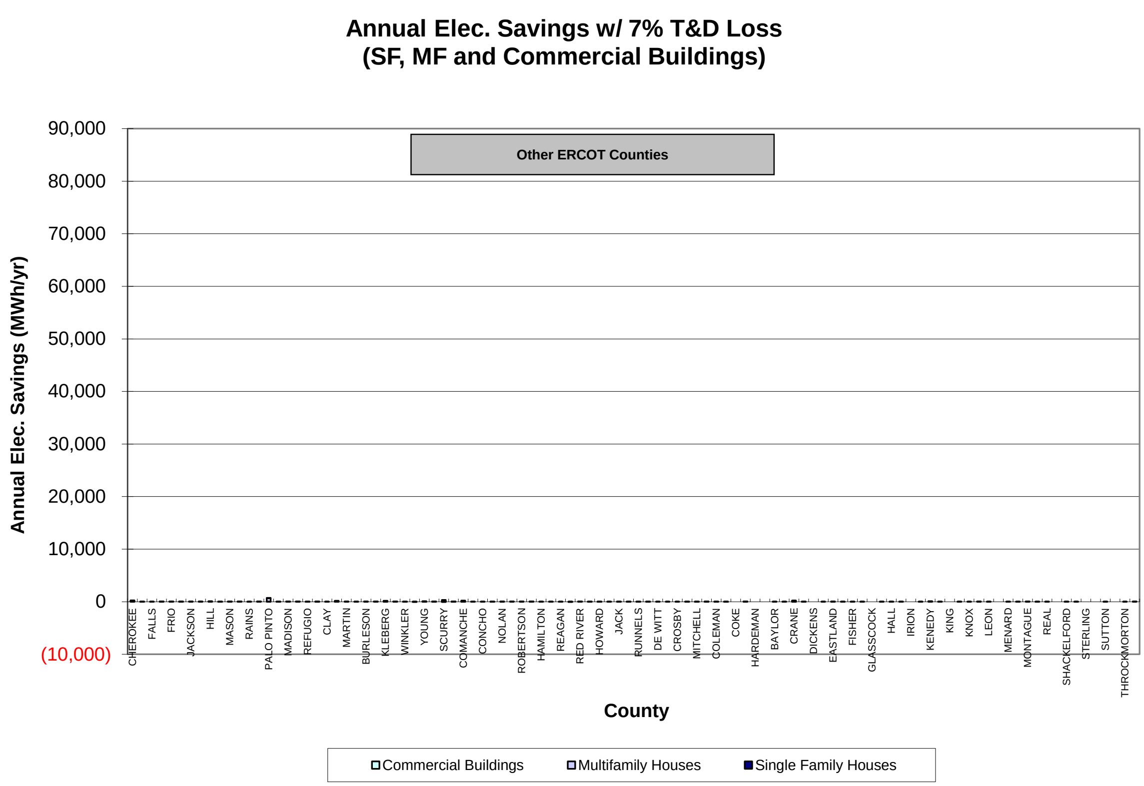


Figure 162: 2010 Annual Electricity Reductions from the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County

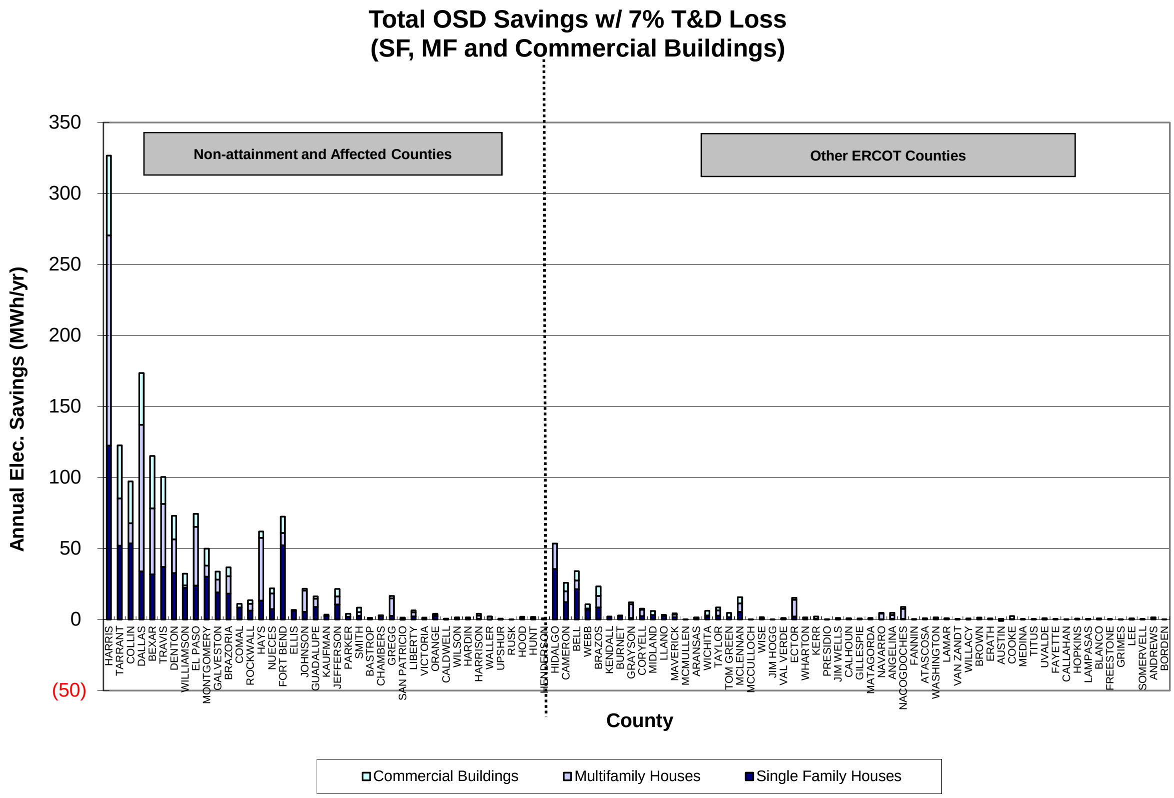
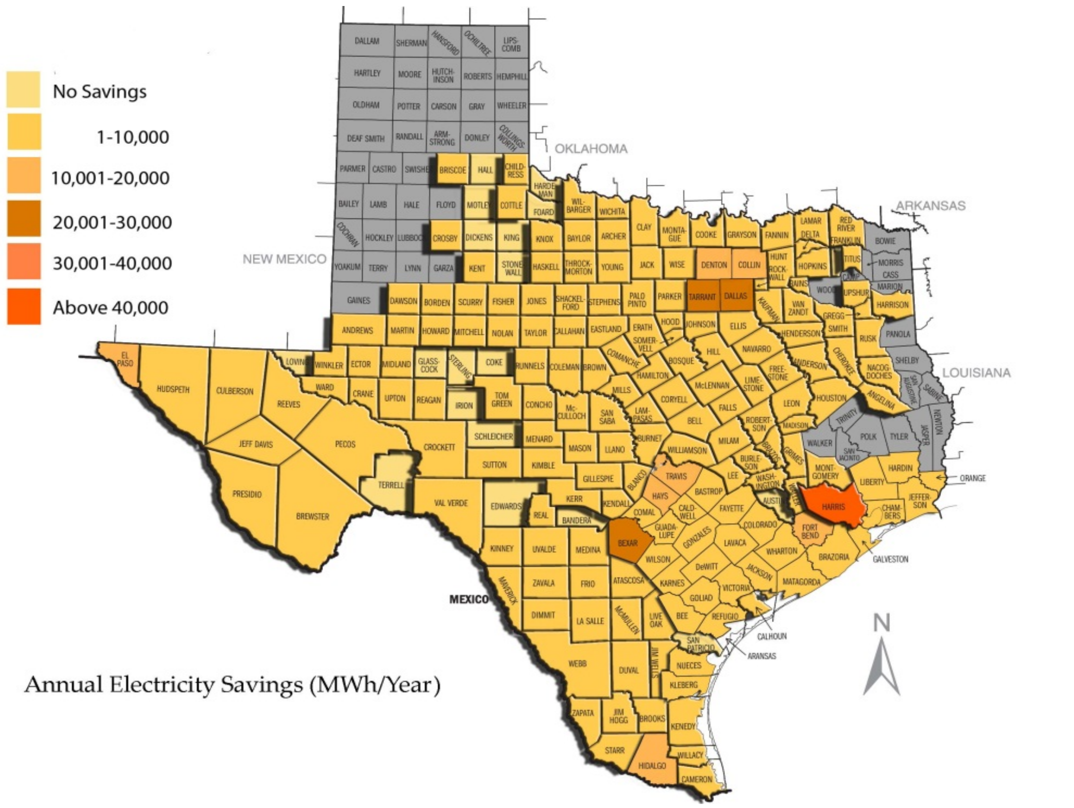


Figure 163: 2010 OSD Electricity Reductions from the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County



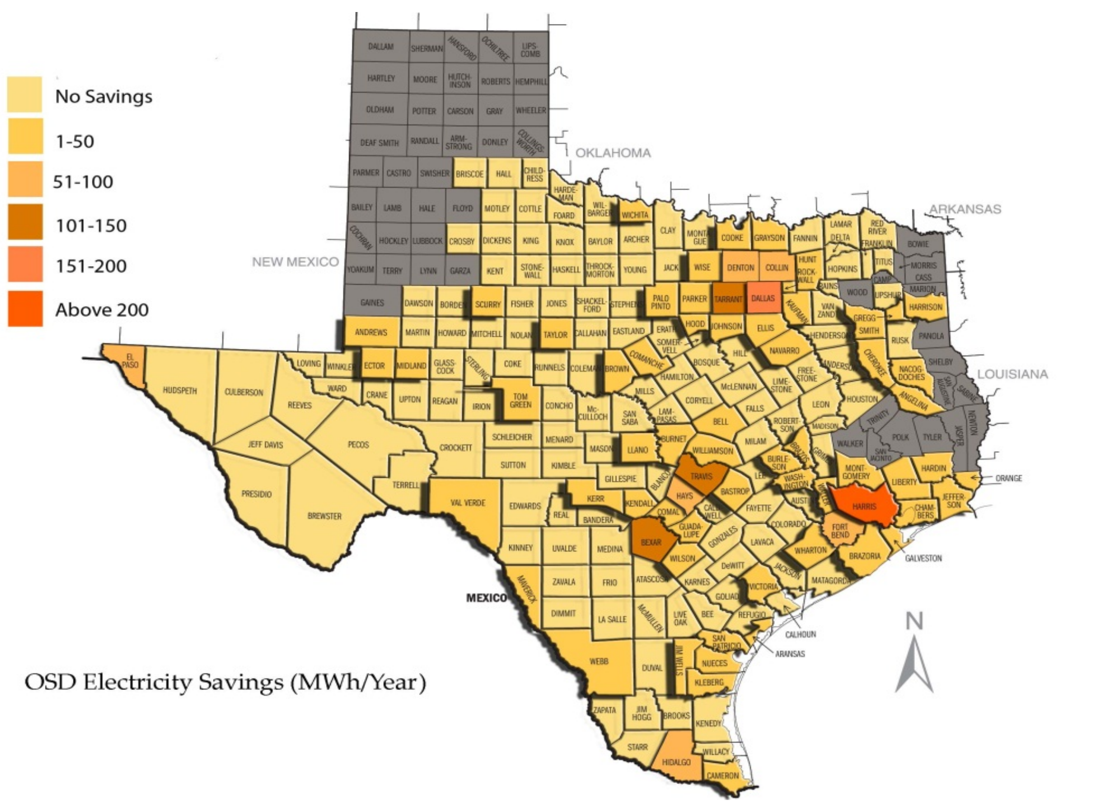
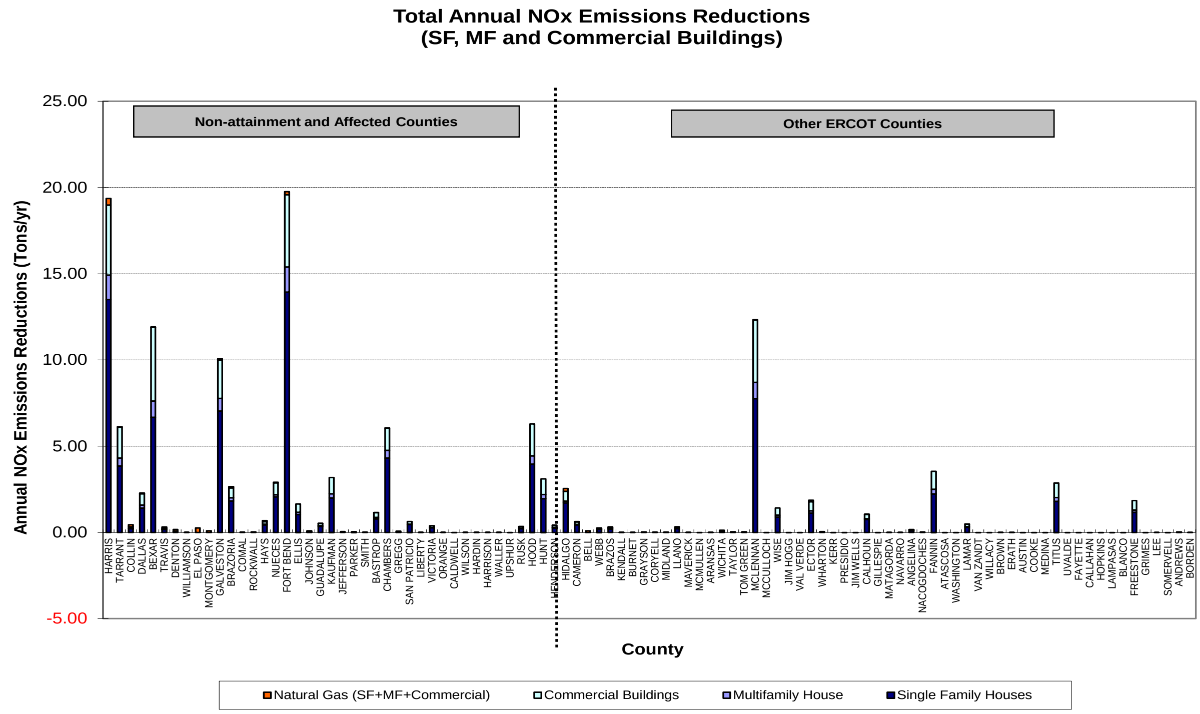


Figure 164: 2010 Annual and OSD Electricity Reductions from the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County



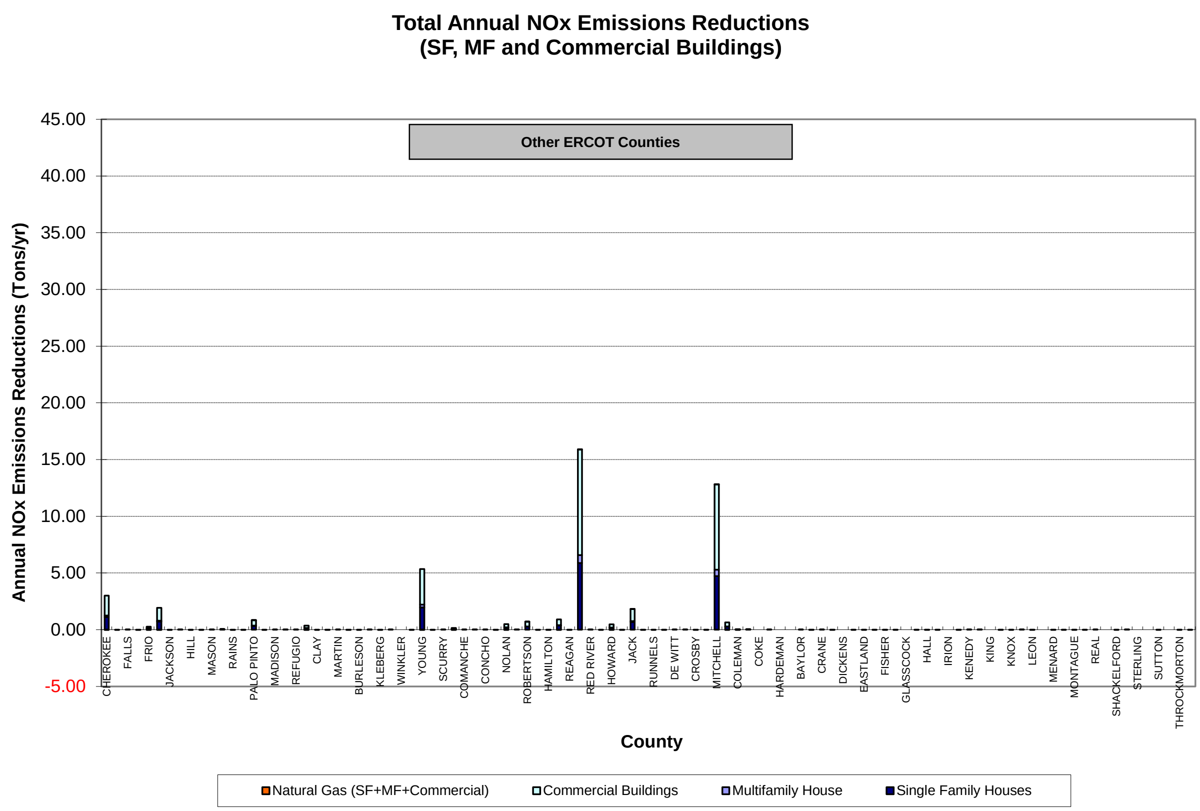
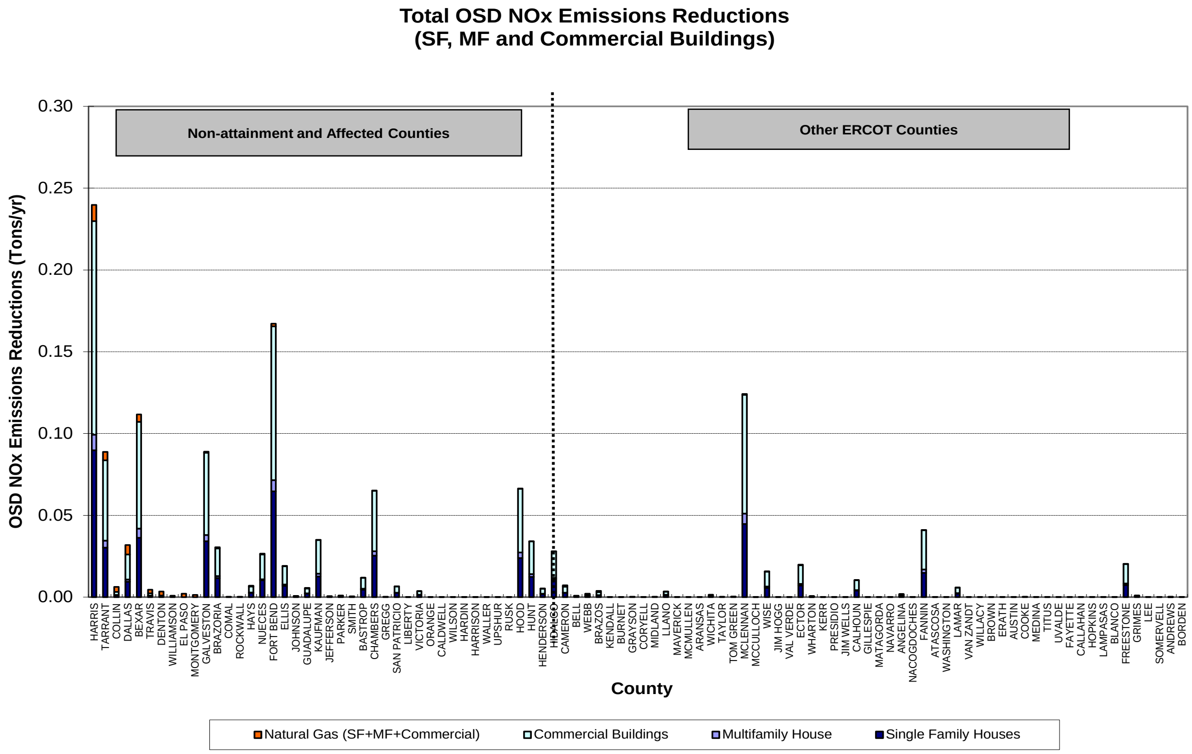


Figure 165: 2010 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County (using 1999 eGRID)



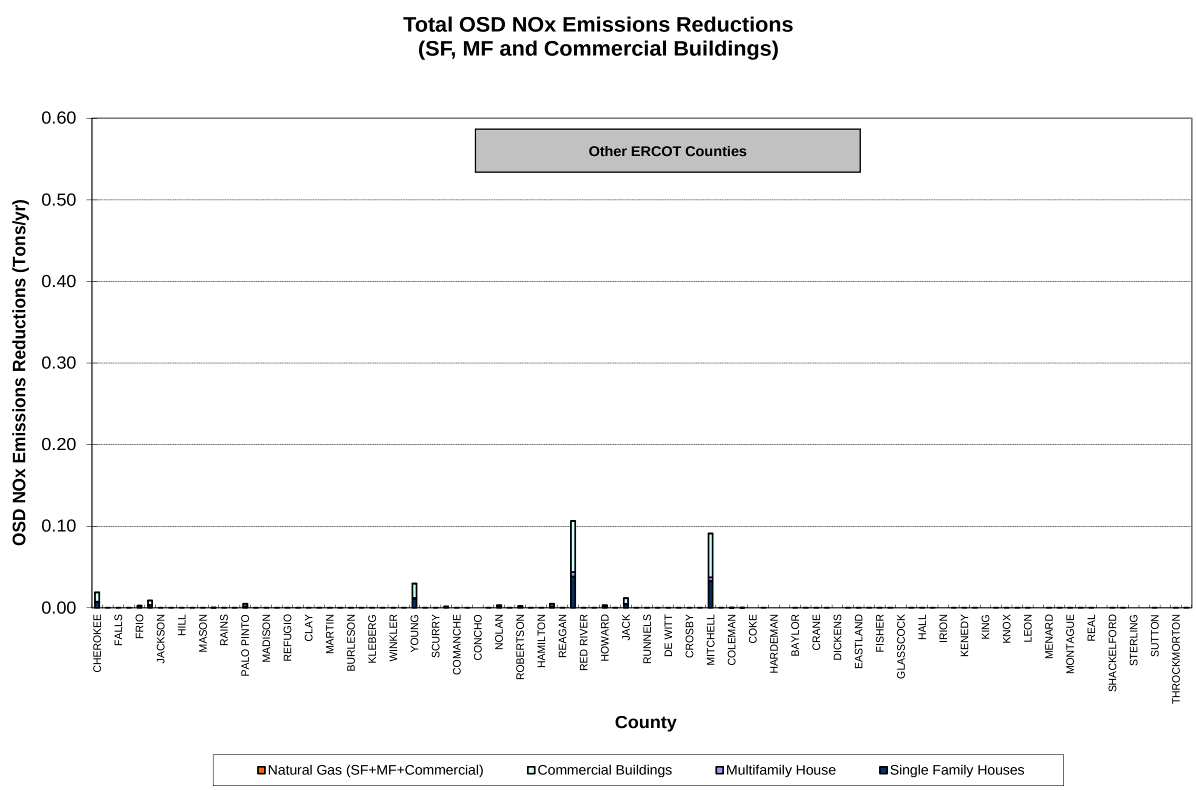
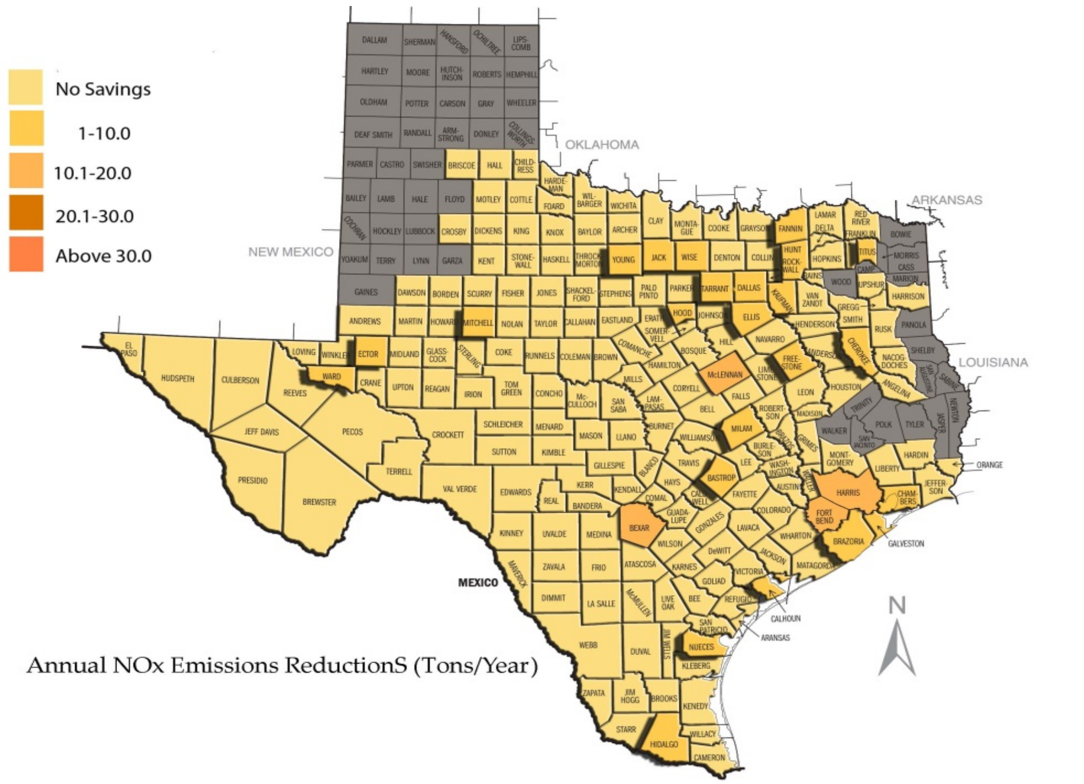


Figure 166: 2010 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County (using 2007 eGRID)



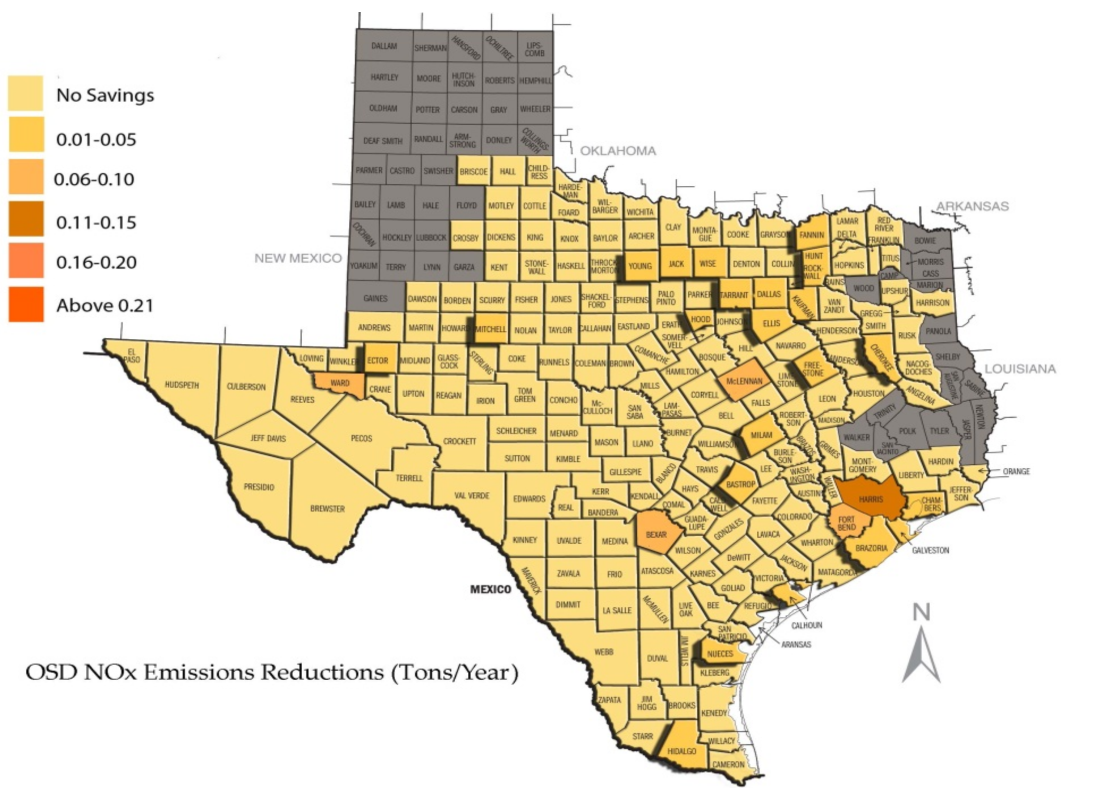
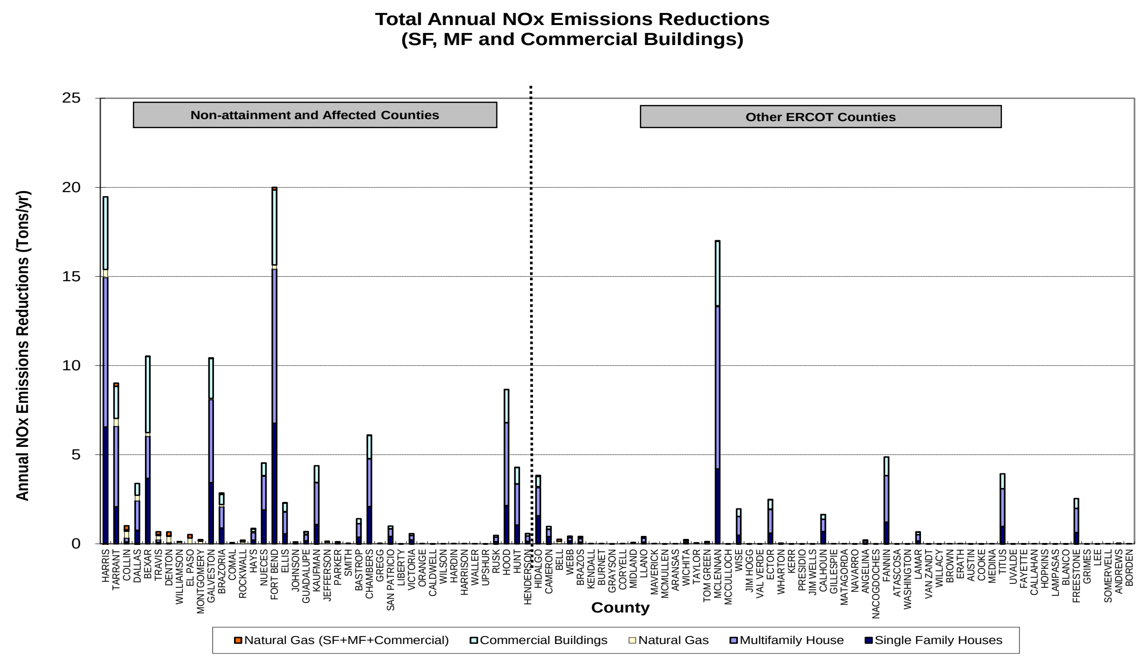


Figure 167: 2010 Annual and OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County (using 2007 eGRID)

7 Comparison of 2010 Emissions Reductions vs. 2009 Emissions Reductions

In this section a side-by-side comparison is presented of the 2010 emissions reductions calculations versus the 2009 emissions reductions for both the annual and Ozone Season Day (OSD). In Figure 169 and Figure 170 the annual and OSD NOx reductions are presented for the 2009 analysis, respectively. These can be compared to the values presented in Figure 171 and Figure 172 for the 2010 analysis.



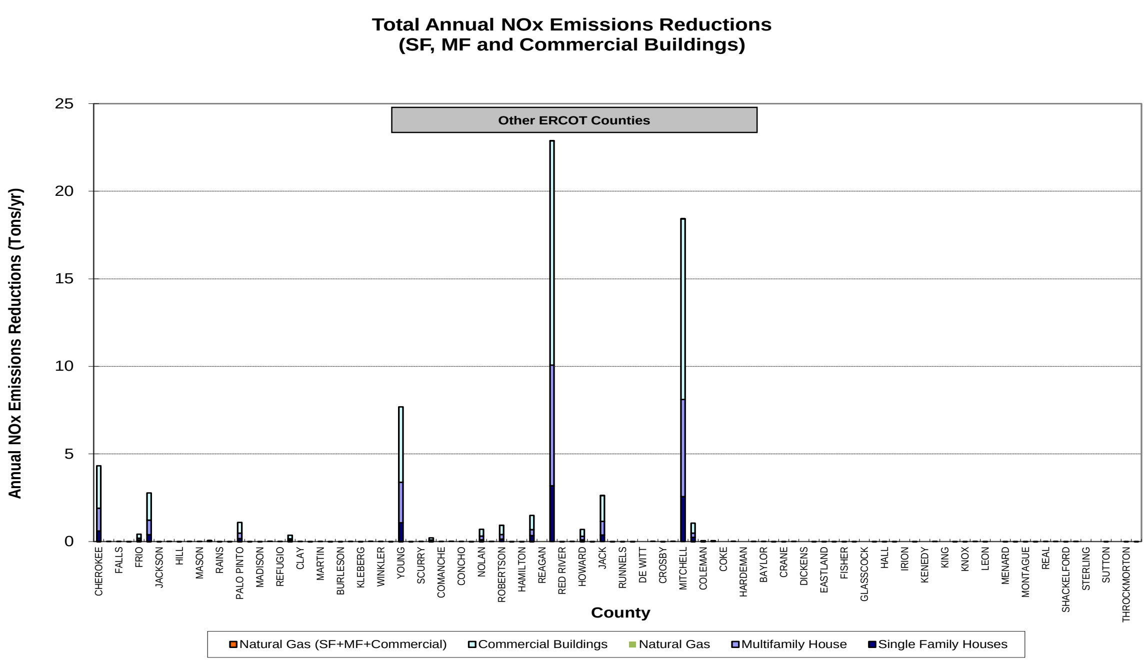
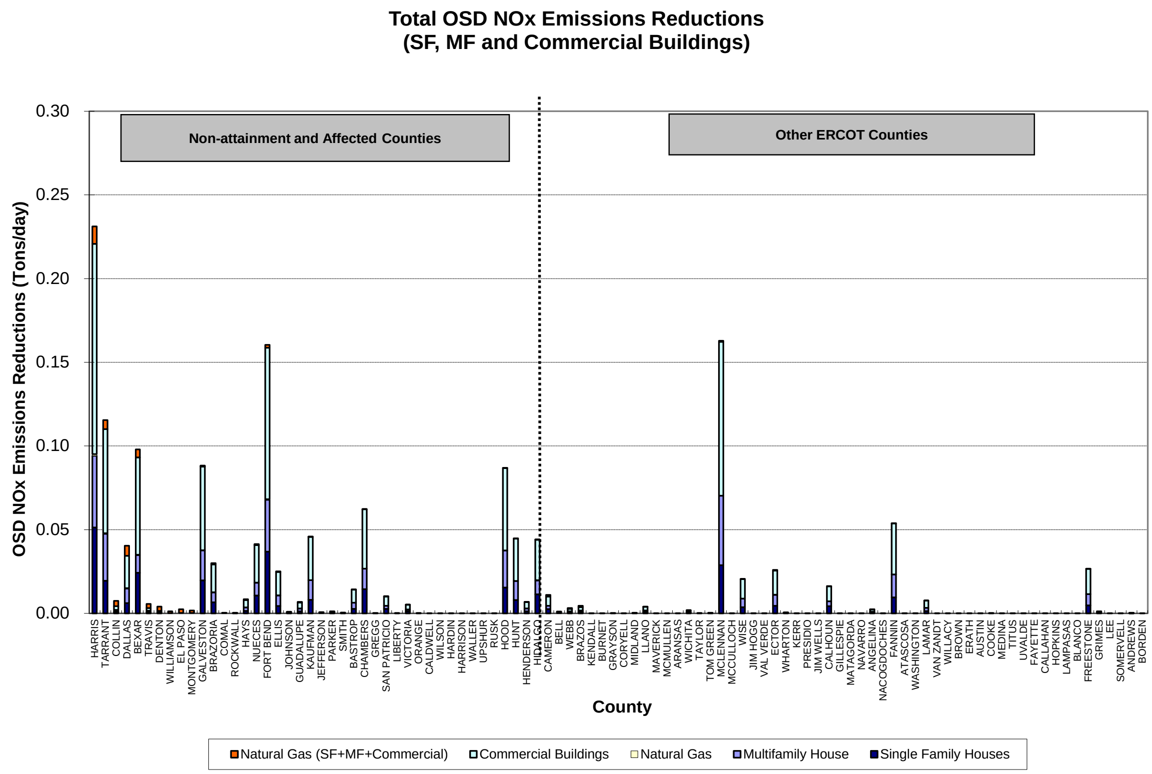


Figure 168: 2009 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family, Multi-family Residences, and the 90.1-1999 Commercial Buildings by County (using 2007 eGRID)



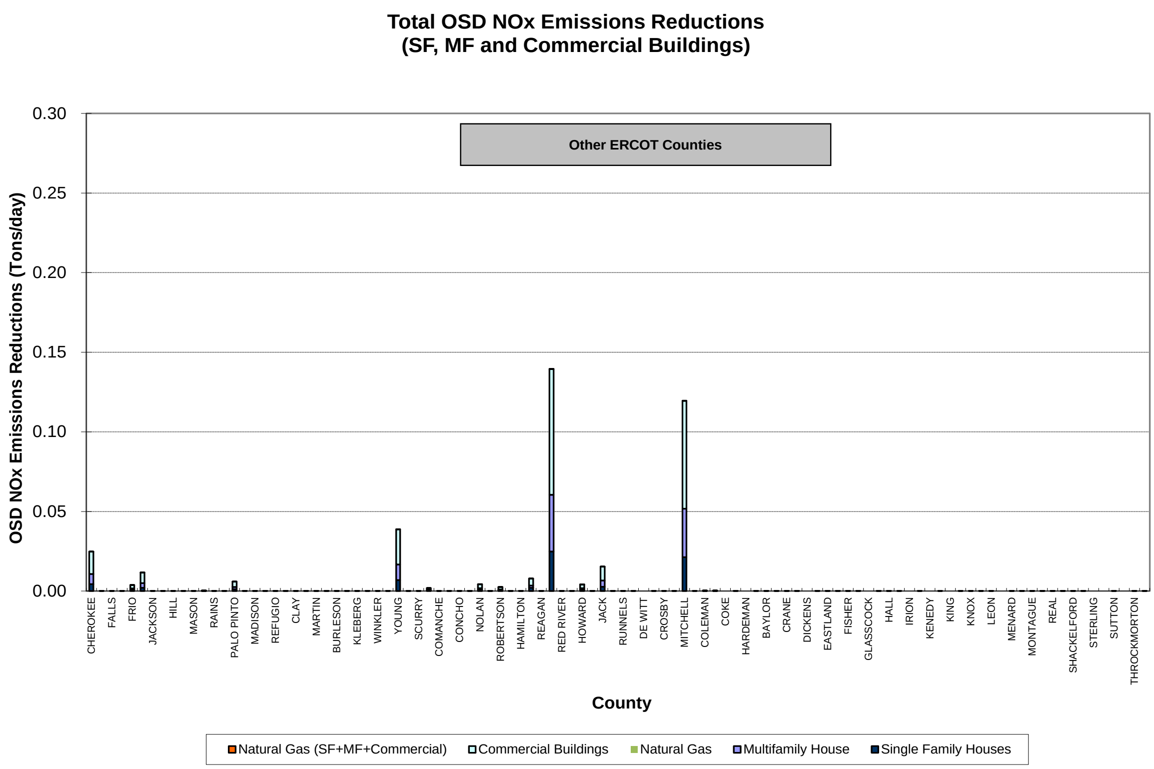
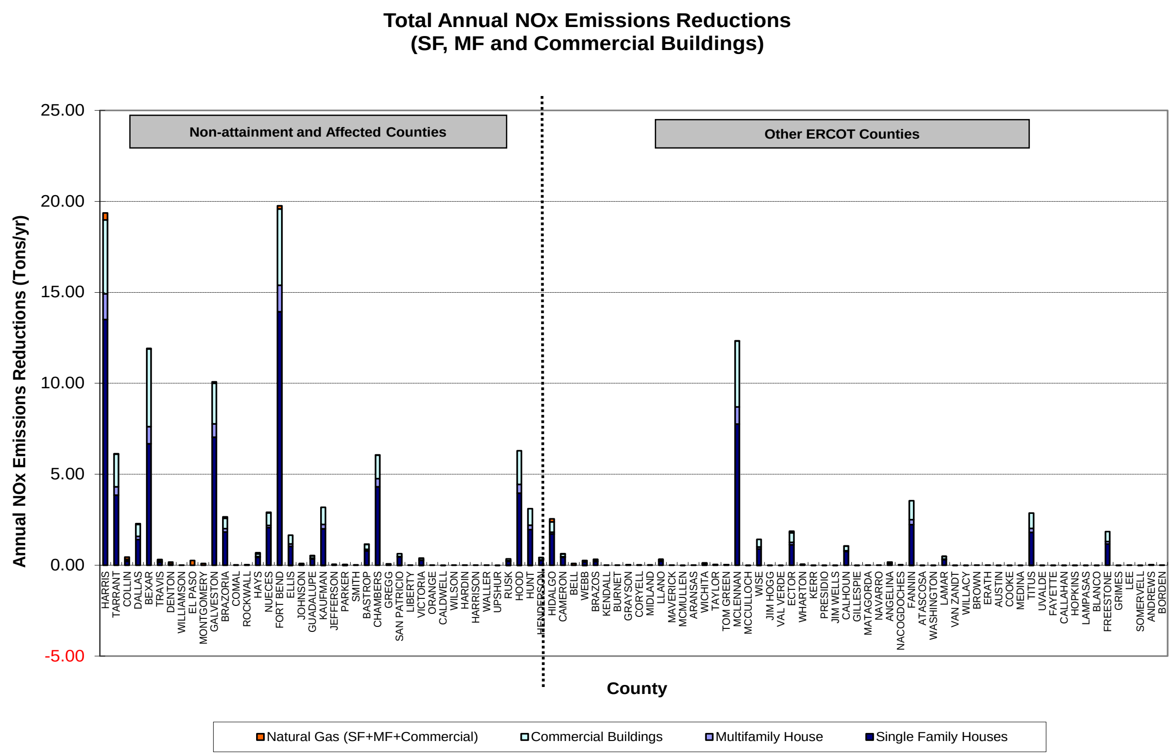


Figure 169: 2009 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family, Multi-family Residences, and the 90.1-1999 Commercial Buildings by County (Using 2007 eGRID)



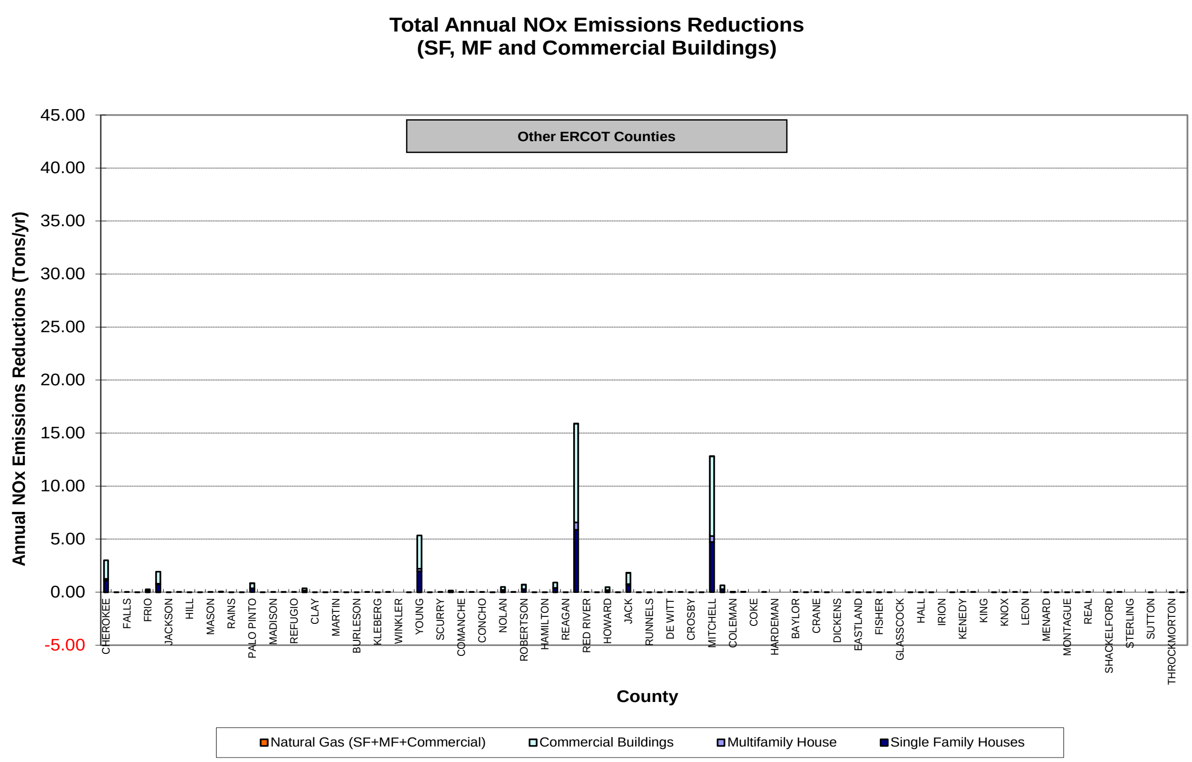
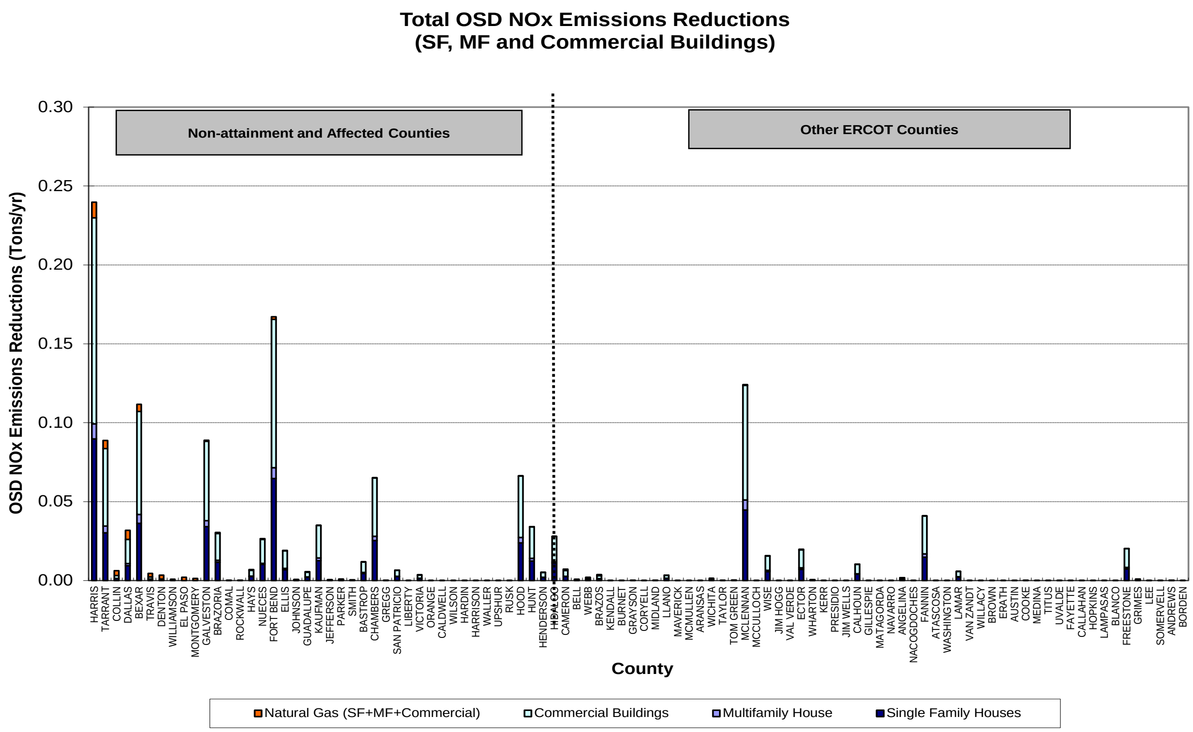


Figure 170: 2010 Annual NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County (using 1999 eGRID)



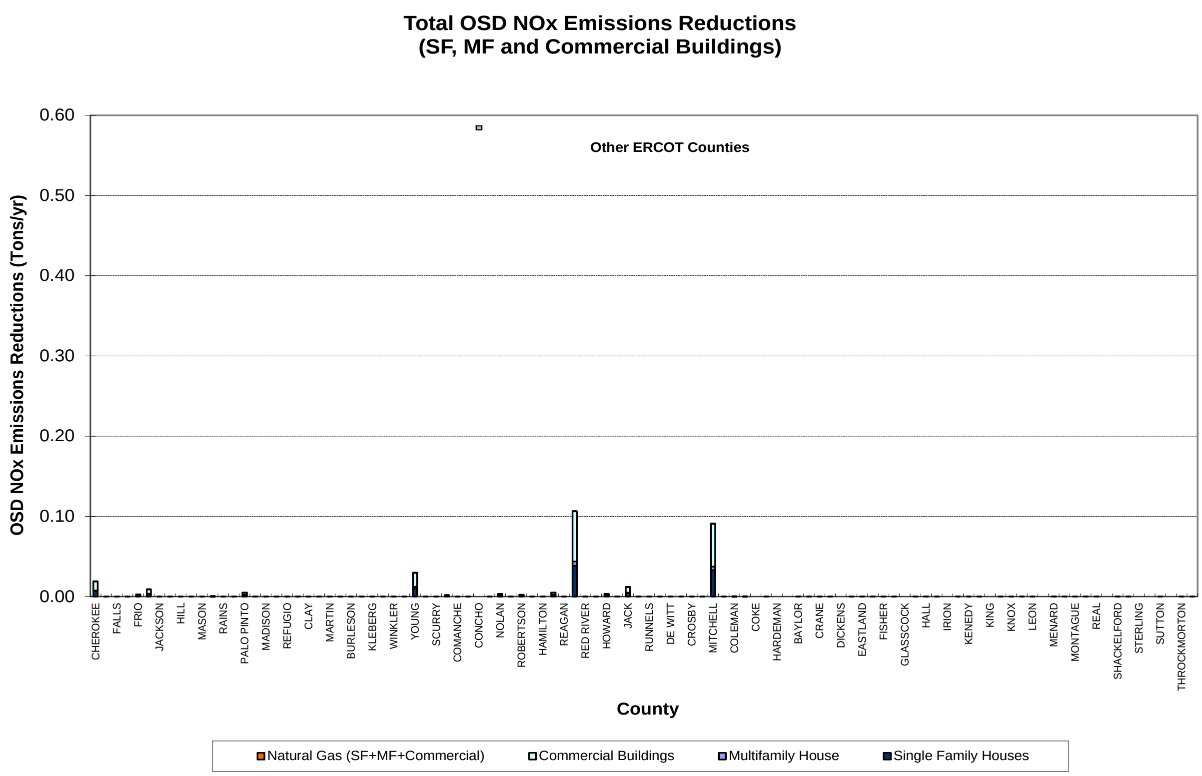


Figure 171: 2010 OSD NOx Reductions from Electricity and Natural Gas Savings Due to the 2000 IECC / IRC for Single-family and Multi-family Residences and the 90.1-1999 for Commercial Buildings by County (using 2007 eGRID).

8 Calculation of Integrated NOx Emissions Reductions from Multiple State Agencies Participating in the Texas Emissions Reduction Plan (TERP)

8.1 Background

In January 2005, the Laboratory was asked by the Texas Commission on Environmental Quality (TCEQ) to develop a method by which the NOx emissions savings from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 could be reported in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the cumulative savings estimates from all projects projected through 2020 for both the annual and Ozone Season Day (OSD) NOx reductions. The NOx emissions reduction from all these programs were calculated using estimated emissions factors for 2007 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose. The different programs included in this 2010 cumulative analysis are:

- ESL Single-family new construction
- ESL Multi-family new construction
- ESL Commercial new construction
- Federal Buildings
- Furnace Pilot Light Program
- PUC Senate Bill 7 and Senate Bill 5 Program
- SECO Senate Bill 5 Program
- Electricity generated by wind farms in Texas (ERCOT)[40]
- SEER13 upgrades to Single-family and Multi-family residences

The Laboratory's single-family and multi-family programs include the energy savings attained by constructing new residences in Texas according to the IECC 2000/2001 building code (IECC 2000). The baseline for comparison for the code programs is the published data on residential construction characteristics by the National Association of Home Builders (NAHB) for 1999 (NAHB 1999). Annual electricity (MWh) and natural gas (MMBtu) savings are from the Laboratory's Annual Reports to the TCEQ (Haberl et al., 2002 - 2010).

The Texas Public Utility Commission's (PUC) Senate Bill and Senate Bill 7 programs include their incentive and rebates programs managed by the different Utilities for Texas (PUC 2007). These include the Residential Energy Efficiency Programs (REEP) as well as the Commercial & Industrial Standard Offer Programs (C&I SOP). The energy efficiency measures include high efficiency HVAC equipment, variable speed drives, increased insulation levels, infiltration reduction, duct sealing, Energy Star Homes, etc. Annual electricity savings according to the utilities (or Power Control Authorities – PCAs) were reported for the different programs completed in the years 2001 through 2010. The PUC also reported the savings from the Senate Bill 5 grant program which was conducted in 2002 and 2003.

The Texas State Energy Conservation Office (SECO) funds energy-efficiency programs are directed towards school districts, government agencies, city and county governments, private industries and residential energy consumers. For the 2010 reporting year SECO submitted annual energy savings values for projects funded by SECO and by Energy Service projects.

The *Electric Reliability Council of Texas (ERCOT) electricity production from currently installed green power generation (wind)* in Texas is reported. Projections through 2013 include planned projects by ERCOT, annual growth factors beyond 2013 comply with the Legislative requirements. Actual measured electricity production for 2001 through 2010, were included.

Finally, NOx emissions reductions from several other programs are also reported, including: *energy efficiency measures applied to Federal buildings in Texas, reductions from the elimination of pilot lights in residential furnaces, and reductions from the installation of SEER 13 air conditioners in existing residences.*

[40] ERCOT is the Electric Reliability Council of Texas.

8.2 Description of the Analysis Method

Annual and Ozone Season Day (OSD) NOx emissions reduction were calculated for 2010 and cumulatively from 2006 to 2020 using several factors to discount the potential savings. These factors include an annual degradation factor, a transmission and distribution factor, a discount factor and growth factors as shown in Table 63, and are described as follows:

Annual degradation factor: This factor was used to account for an assumed decrease in the performance of the measures installed as the equipment wears down and degrades. With the exception of electricity generated from wind, an annual degradation factor of 5% was used for all the programs[41]. This value was taken from a study by Kats et al. (1996).

Transmission and distribution loss: This factor adjusts the reported savings to account for the loss in energy resulting from the transmission and distribution of the power from the electricity producers to the electricity consumers. For this calculation, the energy savings reported at the consumer level are increased by 7% to give credit for the actual power produced that is lost in the transmission and distribution system on its way to the customer. In the case of electricity generated by wind, the T&D losses were assumed to cancel out since wind energy is displacing power produced by conventional power plants; therefore, there is no net increase or decrease in T&D losses.

Initial discount factor: This factor was used to discount the reported savings for any inaccuracies in the assumptions and methods employed in the calculation procedures. For the Laboratory's single- and multi-family program, the discount factor was assumed to be 20%. For PUC's Senate Bill 5 and Senate Bill 7 programs and electricity from wind, the discount factor was taken as 25%. For the savings in the SECO program, the discount factor was 60%.

Growth factor: The growth factors shown in Table 63 were used to account for several different factors. Growth factors for single-family (3.25%) and multi-family residential (1.54%) construction are projections based on the average growth rate for these housing types from recent U.S. Census data for Texas. Growth factors for wind energy are from the Texas Public Utilities Commission[42]. No growth was assumed for Federal buildings, pilot lights, PUC programs and SECO entries.

Figure 173: Process Flow Diagram of the NOx Emissions Reduction Calculations shows the overall information flow that was used to calculate the NOx emissions savings from the annual and Ozone Season Day (OSD) electricity savings (MWh) from all programs. For the Laboratory's single-family and multi-family code-implementation programs, the annual and ozone season savings were calculated from DOE-2 hourly simulation models[43]. The base case is taken as the average characteristics of single- and multi-family residences for Texas published by the National Association of Home Builders for 1999 (NAHB 1999). The OSD consumption is the average daily consumption for the period between July 15 and September 15, 1999. The annual electricity savings from PUC programs were calculated using deemed savings tables and spreadsheets created for the utilities incentive programs by Frontier Associates in Austin, Texas (PUC 2007).

The SECO electricity savings were submitted as annual savings by project[44]. A description of the measures completed for the project was also submitted for information purposes. The electricity production from wind farms in Texas was from the actual on-site metered data measured at 15-minute intervals.

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[41] A degradation of 5% per year would accumulate as a 5%, 10%, 15%...etc., degradation in performance. Although the assumption of this high level of degradation may not actually occur, it was chosen as a conservative estimate. For wind energy, a degradation factor of 0% was used. The choice of a 0% degradation factor for wind is based on two years of analysis of measured wind data from all Texas wind farms that shows no degradation, on average, for a two year period after the wind farms became operational.

[42] The growth factors for wind energy through 2012 are based on permitted wind farms registered with the Texas Public Utilities Commission, http://www.puc.state.tx.us/electric/maps/gen_tables.xls. Growth factors for 2013 through 2020 assume a linear projection based on the permits for 2011 and 2012.

[43] These values are based on a performance analysis as defined by Chapter 4 of IECC 2000/2001. This analysis is discussed in the Laboratory's annual reports to the TCEQ.

[44] The reporting requirements to the SECO did not require energy savings by project type, although for selected sites, energy savings by project type was available. Annual savings were reported by SECO in 2004. Values for 2005 to 2010 use the adjusted values from 2004.

Integration of the savings from the different programs into a uniform format allowed for creditable NOx emissions to be evaluated using different criteria as shown in Table 63. These include evaluation across programs, evaluation across individual counties by program, evaluation by SIP area, evaluation for all ERCOT counties except Houston/Galveston, and evaluation within a 200 km radius of Dallas/Ft.Worth.

8.3 Calculation Procedure

ESL Single-family and Multi-family. The calculation of the annual and OSD electricity savings reported for the years 2002 through 2010 included the savings from code-compliant new housing in all 41 non-attainment and affected counties as reported in the Laboratory's annual report submitted by the Laboratory to the Texas Commission of Environmental Quality (TCEQ). The savings for 2001 were also incorporated, since some of the programs were reporting savings from September to December 2001. From 2005 to 2010, the annual and OSD electricity savings were calculated for new residential construction in all the counties in ERCOT region, which includes the 41 non-attainment and affected counties. These savings were then tabulated by county and program. Using the calculated values through 2010, savings were then projected to 2020 by incorporating the different adjustment factors mentioned above.

In these calculations, it was assumed that the same amount of electricity savings from the code-complaint construction would be achieved for each year after 2010 through 2020[45]. The projected energy savings through 2020, according to county, were then divided into the different Power Control Authorities (PCA) in eGRID. To determine which PCA was to be used, or in counties with multiple PCA, the allocation to each PCA by county was obtained from PUC's listing published in the Laboratory's 2009 annual report[46].

For the 2010 annual and OSD NOx emissions calculations, the US EPA's 2007 eGRID were used[47]. An example of the eGRID spreadsheet[48] is given in Table 66. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different counties using the emissions factors contained in eGRID. Similar calculations were performed for each year for which the analysis was required. The cumulative NOx emissions reduction for the electricity savings from residential new construction for 2005 through 2020 is provided in Table 65. NOx emissions reduction is provided in Table 66 .

ESL-Commercial Buildings. The annual and OSD electricity savings for 2004 through 2009 for commercial buildings were obtained from the annual reports for 2004 through 2009 submitted by the Laboratory to TCEQ[49]. These savings were also tabulated by county and program. Using the calculated values through 2010, savings were then projected to 2020 by incorporating the different adjustment factors mentioned above[50]. In the projected annual electricity savings, it was assumed that the same 2010 amount of electricity savings would be achieved for each year through 2020. Similarly to the single family calculations, the projected energy saving numbers through 2020, by county, were allocated into the appropriate Power Control Authorities (PCA).

Federal Buildings. Energy savings achieved from Energy Savings Performance Contracts (ESPCs) were also reported in 2005. This includes savings (estimated) from energy conservation measures implemented in Federal Buildings in Texas. The 2010 savings include projects implemented in 13 Federal buildings reported by the regional office of the Department of Energy. Annual kWh savings reported for each of the projects were divided by 365 to

[45] This would include the appropriate discount and degradation factors for each year.
[46] Haberl et al., 2010, pp. 265.
[47] This required two separate versions of the 2007 eGRID, which were specially prepared for Texas by Mr. Art Diem at the US EPA. One of the versions contains estimates of annual SOx, NOx and CO2 data for 2007, using a 25% capacity factor. The second version contains estimates of SOx, NOx and CO2 data for 2007 for an average day in the ozone season period, which runs from Mid-July to Mid-September.
[48] To use this spreadsheet electricity savings for each PCA is entered in the bottom row of the spreadsheet (MWh). The spreadsheet then allocates the MWh of electricity savings according to the counties (blue columns) where the PCA owned and operated a power plant. Totals for all PCAs are then listed on the far right columns (white columns). Similar spreadsheets for the 2007 eGRID exist for SOx and CO2.
[49] These savings include new construction in office, assembly, education, retail, food, lodging and warehouse construction as defined by Dodge building type (Dodge 2005), using energy savings from the Pacific Northwest National Laboratory (USDOE 2004), and data from CBECS (1995 - 2003).
[50] This also includes the appropriate discount and degradation factors for each year.

obtain the average Ozone Season Day savings[51]. In the calculation for 2010, it was assumed that the electricity savings from 2005 would also be achieved for each year from 2006 through 2020 after the appropriate degradation factors and T&D loss were applied. Similarly to the single family calculations, the projected energy saving numbers through 2020, by county, were proportioned into the PUC's Power Control Authorities (PCA) and the cumulative NOx emission reduction values calculated.

Furnace Pilot Light Program. For the furnace pilot light program savings, the natural gas (N.G.) energy savings achieved by retrofitting existing furnaces in single-family and multi-family residences for the entire residential stock for Texas have been projected until 2020. Pilot light removal saves an estimated 500 Btu/hr of natural gas for each hour of operation for the entire life of the furnace when the furnace is replaced with a code-compliant replacement. The energy savings for the Ozone Season Day (OSD) are calculated by dividing the annual number by 365. It is also being assumed that of the total furnaces that were retrofitted, 75% are operational during the Ozone Season Period. Cumulative NOx emissions reduction for the N.G. savings from the removal of furnace pilot lights were also calculated by county for 2006 through 2020 by SIP area[52].

PUC-Senate Bill 7. For the PUC Senate Bill 7 program savings, the annual electricity savings for 2001 through 2010 were obtained from the Public Utilities Commission[53]. Using these values savings were projected through 2020 by incorporating the different adjustment factors mentioned above. Similar savings were assumed for each year after 2010 until 2020. The 2007 annual and OSD eGRID was also used to calculate the NOx emissions savings for the PUC-Senate Bill 7 program. The total electricity savings for each PCA was used to calculate the NOx emissions reduction for each county using the emissions factors contained in the US EPA's eGRID spreadsheet. The cumulative NOx emissions reduction for each county, by SIP area, for the different programs was then calculated.

PUC-Senate Bill 5 Grants Program. To calculate the annual electricity savings from the PUC's Senate Bill 5 program, electricity savings were also obtained from the Public Utilities Commission[54]. The annual and average day electricity savings were then proportioned according to the PCA and program. Using the actual reported numbers through 2003, savings through 2020 were projected incorporating the different adjustment factors mentioned above[55]. The 2007 annual and OSD eGRID were used to calculate the NOx emissions savings for PUC-Senate Bill 5 Grants Program. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different counties.

SECO Savings. The annual electricity savings from energy conservation projects reported by political subdivisions for 39 counties through 2005 were obtained from the State Energy Conservation Office[56]. These submittals included information gathered from SECO's website[57] and paper submittals[58]. The annual and average day electricity values were then summarized according to county and program. Using the actual reported numbers for 2005, savings through 2020 were projected using the different adjustment factors mentioned above. In a similar fashion to the previous programs, it was assumed that the same amount of electricity savings will be achieved for each year through 2020. The 2007 annual and OSD eGRID were then used to calculate the NOx emissions savings for the SECO program.

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[51] This method yields suitable OSD values for lighting retrofits and/or retrofits that are not weather dependent. In the case of retrofits to cooling systems, weather normalization would increase the OSD savings substantially. Retrofits to heating systems would be reduced by weather normalization.

[52] These use the NOx/MMBtu values provided in the US EPA AP 42 guideline.

[53] In a similar fashion to the previous programs, to obtain the Ozone Season Day (OSD) savings, the annual electricity savings were divided by 365.

[54] In a similar fashion as the PUC's Senate Bill 7 program, the annual electricity savings numbers were then divided by 365 to get average electricity savings per day for OSD calculations. The preferred approach would be to weather-normalize the savings and then calculate savings for the OSD period. However, only annual values were obtained for the 2005 report to the TCEQ. Dividing the annual values by 365 is probably a reasonable approach for lighting projects. However, this undercounts potential savings from electric loads associated with the cooling season.

[55] Since the savings for the PUC's Senate Bill 5 were only reported for two years these savings actually reduced due to the imposed degradation factor.

[56] In a similar fashion as the PUC's Senate Bill 5 and 7 programs, these annual electricity savings numbers were divided by 365 to get average electricity savings per day for the OSD calculations.

[57] This web site was developed for SECO by the Laboratory, at the request of the TCEQ.

[58] In these submittals, there were several municipalities whose electricity or natural consumption increased in 2004 as compared to 2001, which caused the reported savings from these municipalities to be negative. Since no additional information was reported from these projects that might have indicated what the cause of this was, it was assumed that the energy conservation projects were working as designed, but that other factors had changed the energy consumption. Therefore, in the final values of electricity savings from the political subdivisions that reported to SECO for the calculation of annual and OSD NOx reductions, the negative savings were omitted.

Electricity Generated by Wind Farms. The measured electricity production from all the wind farms in Texas for 2001 through 2010 was obtained from the Energy Reliability Council of Texas (ERCOT). To obtain the annual production, the 15-minute data were summed for the 12 months, while for the OSD period the data were converted to average daily electricity production during the months of July, August and September. Using the reported numbers for 2010, savings through 2020 were projected incorporating the different adjustment factors mentioned above. The 2007 annual and OSD eGRID were then used to calculate the NOx emissions reduction for the electricity generated by Texas' wind farms[59]. The total electricity savings for each PCA was used to calculate the NOx emissions reduction for each of the different counties.

SEER 13 Single-Family and Multi-family. In January of 2006, Federal regulations mandated that the minimum efficiency for residential air conditioners be increased to SEER 13 from the previous SEER 10. Although the electricity savings from new construction reflected this change in values, the annual and OSD electricity savings from the replacement of the air conditioning units by air conditioners with an efficiency of SEER 13 in existing residences needed to be calculated.

In the 2010 report to the TCEQ, the annual and OSD electricity savings for all the counties in ERCOT region as well as the 41 non-attainment and affected counties were calculated. Using the numbers for 2006, the savings through 2020 were projected by incorporating the appropriate adjustment factors.[60] In this analysis it was assumed that an equal number of existing houses had their air conditioners replaced, as reported for 2006, by the air conditioner manufacturers. This replacement rate continued until all the existing air conditioner stock was replaced with SEER 13 air conditioners. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different county using the emissions factors contained in the 2007 eGRID. Cumulative NOx emissions reduction for each county by SIP area was also calculated..

8.4 Results

The total cumulative annual and OSD electricity savings for all the different programs in the integrated format was calculated using the adjustment factors shown in Table 63: Table Final Adjustment Factors used for the Calculation of the Annual and OSD NOx Savings for the Different Programs for 2005 through 2020 as shown in Table 65: Annual and OSD Electricity Savings for the Different Programs. NOx emissions reduction from the electricity and natural gas savings for the annual and OSD for all the programs in the integrated format is shown in Table 66. In Table 64 and Table 65, annual integrated values are shown for 2006 through 2020. The OSD NOx emissions reduction is also shown in Figure 174 as stacked bar charts and in Figure 175 for the individual components.

In 2010 (Table 66), the total cumulative annual savings from all programs in 2010 is 31,731,502 MWh/year (30,984,680 MWh/year and 2,548,904 MMBtu/year). The annual integrated electricity savings[61] from all the different programs is:

- Savings from code-compliant residential and commercial construction is 1,854,699 MWh/year (5.8% of the total electricity savings),
- Savings from retrofits to Federal buildings is 293,659 MWh/year (0.9%),
- Savings from furnace pilot light retrofits is 2,548,904 MMBtu/year (2.4%), which is equivalent to 746,822 MWh/year,
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 2,595,953 MWh/year (8.2%),
- Savings from SECO's Senate Bill 5 program is 468,611 MWh/year (1.5%),
- Electricity savings from green power purchases (wind) is 24,210,883 MWh/year (76.3%), and
- Savings from residential air conditioner retrofits[62] is 1,560,875 MWh/year (4.9%).

[59] This credited the electricity generated by the wind farm to the utility that either owned the wind farm or was associated with the wind farm owner.
[60] Additional details about this calculation are contained in the Laboratory's 2006 Annual Report to the TCEQ, available at the ESL's web site "esl.tamu.edu", under TERP.
[61] This includes the savings from 2005 through 2010.
[62] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.

In 2010, the total cumulative OSD savings from all programs in 2010 is 84,150 MWh/day (82,104 MWh/day and 6,983 MMBtu/day), which would be a 3,506 MW average hourly load reduction during the OSD period. The cumulative OSD electricity savings from all the different programs is:

- Savings from code-compliant residential and commercial construction is 10,641 MWh/day (12.6%),
- Savings from retrofits to Federal buildings is 805 MWh/day (1.0%),
- Savings from furnace pilot light retrofits is 6,983 MMBtu/day (2.4%), which is equivalent to 2,046 MWh/day,
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 7,113 MWh/day (8.5%),
- Savings from SECO's Senate Bill 5 program is 1,284 MWh/day (1.5%),
- Electricity savings from green power purchases (wind) are 51,190 MWh/day (60.8%), and
- Savings from residential air conditioner retrofits are 11,071 MWh/day (13.2%).

By 2013, the total cumulative annual savings from all programs will be 35,758,047 MWh/year (35,011,225 MWh/year and 2,548,904 MMBtu/year). The cumulative annual electricity savings from all the different programs is:

- Savings from code-compliant residential and commercial construction will be 2,311,539 MWh/year (6.5% of the total electricity savings),
- Savings from retrofits to Federal buildings will be 402,732 MWh/year (1.1%),
- Savings from furnace pilot light retrofits will remain at 2,548,904 MMBtu/year (2.1%), which is equivalent to 746,822 MWh/year,
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 3,224,560 MWh/year (9.0%),
- Savings from SECO's Senate Bill 5 program will be 489,440 MWh/year (1.4%),
- Electricity savings from green power purchases (wind) will be 26,296,721 MWh/year (73.5%), and
- Savings from residential air conditioner retrofits[63] will be 2,286,233 MWh/year (6.4%).

By 2013, the total cumulative OSD savings from all programs will be 98,298 MWh/day (96,252 MWh/day and 6,983 MMBtu/day), which would be a 4,096 MW average hourly load reduction during the OSD period. The cumulative OSD electricity savings from all the different programs is:

- Savings from code-compliant residential and commercial construction will be 13,157 MWh/day (13.4%),
- Savings from retrofits to Federal buildings will be 1,103 MWh/day (1.1%),
- Savings from furnace pilot light retrofits will remain at 6,983 MMBtu/day (2.1%), which is equivalent to 2,046 MWh/day,
- Savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 8,835 MWh/day (9.0%),
- Savings from SECO's Senate Bill 5 program will be 1,341 MWh/day (1.4%),
- Electricity savings from green power purchases (wind) will be 55,600 MWh/day (56.6%), and
- Savings from residential air conditioner retrofits will be 16,216 MWh/day (16.5%).

In 2010 (Table 66), the total cumulative annual NOx emissions reduction from all programs is 18,907 tons-NOx/year. The cumulative annual NOx emissions reduction[64] from all the different programs is:

- NOx emissions reduction from code-compliant residential and commercial construction is 1,303 tons-NOx/year (6.9% of the total NOx savings),
- NOx emissions reduction from retrofits to Federal buildings is 225 tons-NOx/year (1.2%),
- NOx emissions reduction from furnace pilot light retrofits is 117 tons-NOx/year (0.6%),
- NOx emissions reduction from the PUC's Senate Bill 5 and Senate Bill 7 programs is 1,783 tons-NOx/year (9.4%),
- NOx emissions reduction from SECO's Senate Bill 5 program is 357 tons-NOx/year (1.9%),
- NOx emissions reduction from green power purchases (wind) is 14,047 tons-NOx/year (74.3%), and
- NOx emissions reduction from residential air conditioner retrofits is 1,075 tons-NOx/year (5.7%).

In 2010, the total cumulative OSD NOx emissions reduction from all programs is 51.58 tons-NOx/day. The cumulative OSD NOx emissions reduction from all the different programs is:

[63] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.
[64] These NOx emissions reductions were calculated with the US EPA's 2007 eGRID for annual (25% capacity factor) and Ozone Season Day OSD.

- NOx emissions reduction from code-compliant residential and commercial construction is 7.34 tons-NOx/day (14.2%),
- NOx emissions reduction from retrofits to Federal buildings is 0.59 tons-NOx/day (1.1%),
- NOx emissions reduction from furnace pilot light retrofits is 0.32 tons-NOx/day (0.6%),
- NOx emissions reduction from the PUC's Senate Bill 5 and Senate Bill 7 programs is 4.79 tons-NOx/day (9.3%),
- NOx emissions reduction from SECO's Senate Bill 5 program is 0.97 tons-NOx/day (1.9%),
- NOx emissions reduction from green power purchases (wind) are 30.04 tons-NOx/day (58.2%), and
- NOx emissions reduction from residential air conditioner retrofits are 7.53 tons-NOx/day (14.6%).

By 2013, the total cumulative annual NOx emissions reduction from all programs will be 21,396 tons-NOx/year. The cumulative annual NOx emissions reduction from all the different programs is:

- NOx emissions reduction from code-compliant residential and commercial construction will be 1,620 tons-NOx/year (7.6% of the total NOx savings),
- NOx emissions reduction from retrofits to Federal buildings will be 308 tons-NOx/year (1.4%),
- NOx emissions reduction from furnace pilot light retrofits will be 117 tons-NOx/year (0.5%),
- NOx emissions reduction from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 2,147 tons-NOx/year (10.0%),
- NOx emissions reduction from SECO's Senate Bill 5 program will be 373 tons-NOx/year (1.7%),
- NOx emissions reduction from green power purchases (wind) will be 15,257 tons-NOx/year (71.3%), and
- NOx emissions reduction from residential air conditioner retrofits will be 1,574 tons-NOx/year (7.4%).

By 2013, the total cumulative OSD NOx emissions reduction from all programs is 60.61 tons-NOx/day. The cumulative OSD NOx emissions reduction from all the different programs is:

- NOx emissions reduction from code-compliant residential and commercial construction will be 9.03 tons-NOx/day (14.9%),
- NOx emissions reduction from retrofits to Federal buildings will be 0.81 tons-NOx/day (1.3%),
- NOx emissions reduction from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.5%),
- NOx emissions reduction from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 5.78 tons-NOx/day (9.5%),
- NOx emissions reduction from SECO's Senate Bill 5 program will be 1.01 tons-NOx/day (1.7%),
- NOx emissions reduction from green power purchases (wind) will be 32.63 tons-NOx/day (53.8%), and

NOx emissions reduction from residential air conditioner retrofits will be 11.03 tons-NOx/day (18.2%).

Table 63: Table Final Adjustment Factors used for the Calculation of the Annual and OSD NOx Savings for the Different Programs

	ESL-Single Family[16]	ESL-Multifamily[16]	ESL-Commercial[16]	Federal Buildings[15]	Furnace Pilot Light Program[15]	PUC (SB7)[15]	PUC (SB5 Grant Program)[15]	SECO[15]	Wind-ERCOT[8]	SEER13 Single Family	SEER13 Multifamily
Annual Degradation Factor [11]	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	0.00%	5.00%	5.00%
T&D Loss [9]	7.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%
Initial Discount Factor [12]	20.00%	20.00%	20.00%	20.00%	20.00%	25.00%	25.00%	60.00%	25.00%	20.00%	20.00%
Growth Factor	3.25%	1.54%	3.25%	0.00%	0.00%	0.00%	0.00%	0.00%	Actual Rates	N.A.	N.A.
Weather Normalized	Yes	Yes	Yes	No	No	No	No	No	See note 7	Yes	Yes

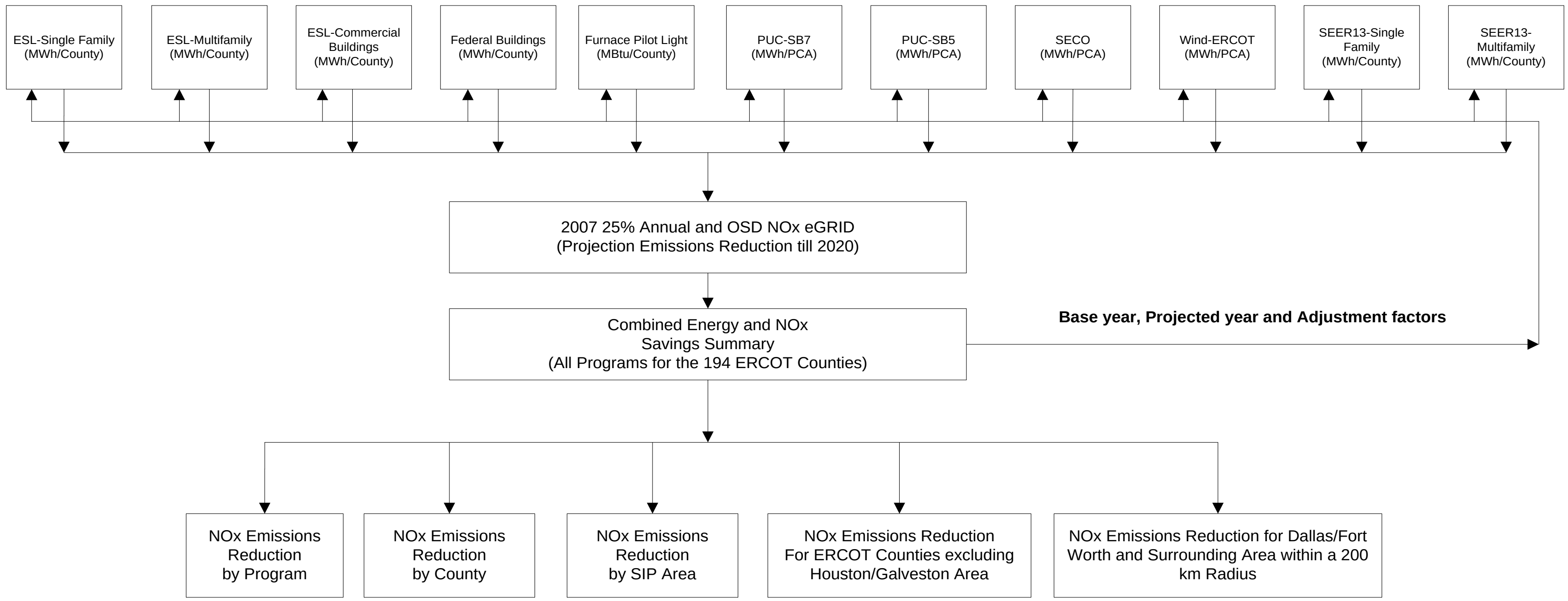

Figure 172: Process Flow Diagram of the NOx Emissions Reduction Calculations

Table 64: Example of NOx Emissions Reduction Calculations using eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.008831132	226.0465792	0.010890729	8.193488679	0.006522185	0	0.003944232	14.32402746	0.065444292	3035.079423	0.014877434	272.3666894	0.006262315	0	0.004817148	0	0.121274957	139.7235344	0.00816387	940.7285451	4636.462287	2.318231144
	Chambers	0.021762222	557.0379581	0.026955801	20.27982242	0.016072371	0	0.009076193	32.96145962	0.164940225	7649.355979	0.037472294	686.0191605	0.015055623	0	0.009553214	0	0.011518588	13.2708178	0.015818592	1822.787617	10781.71281	5.390856407
	Fort Bend	0.070431234	1802.797078	0.087239726	65.63359654	0.052016606	0	0.029374182	106.6764342	0.533812376	24756.36787	0.121275295	2220.231709	0.048726002	0	0.030918012	0	0.037278747	42.94966114	0.051195276	5899.267979	34893.92432	17.44696216
	Galveston	0.033856739	866.6159501	0.041710519	31.3803294	0.025004711	0	0.015351589	55.75143316	0.249587379	11574.99759	0.056747051	1038.889275	0.024143087	0	0.019297151	0	0.567751219	654.118618	0.032836887	3783.817742	18005.57093	9.002785467
	Harris	0.068267332	1747.408655	0.084559408	63.61709594	0.050418468	0	0.028471701	103.3989497	0.517411736	23995.76304	0.117549281	2152.01819	0.047228963	0	0.029968099	0	0.03613341	41.63009278	0.049622373	5718.021208	33821.85723	16.91092861
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.002039135	52.19483875	0.003716345	2.795940278	0.001505992	0	0.005950953	21.61171382	0.002481478	115.0823578	0.000717051	13.12731328	0.019166247	0	0.07668094	0	0.00086441	0.995905867	0.004000199	460.945804	666.7538738	0.333376937
	Dallas	0.004539471	116.1948312	0.004683963	3.523914222	0.003352602	0	0.00774211	28.1165509	0.002085611	96.72341896	0.00068106	12.46842352	0.007502816	0	0.026717045	0	0.007524933	8.669640256	0.040370454	4651.916039	4917.612818	2.458806409
	Denton	0.00047388	12.12970385	0.000872802	0.656640103	0.000349982	0	0.001396994	5.073377767	0.000585443	27.15083393	0.000168971	3.093405773	0.00454374	0	0.018187155	0	0.000186605	0.214992277	0.000849405	97.87758499	146.1965387	0.073098269
	Tarrant	0.012162492	311.3179263	0.012266309	9.228387517	0.008982543	0	0.020308652	73.75369976	0.005316504	246.5610524	0.001752506	32.08377752	0.017326428	0	0.060216761	0	0.020603444	23.73767965	0.110647237	12749.95959	13446.64211	6.723321056
	Ellis	0.003279814	83.95193355	0.003307809	2.488584531	0.002422289	0	0.005476558	19.88888265	0.001433682	66.48919108	0.000472592	8.651911537	0.004672353	0	0.016238427	0	0.005556053	6.401250735	0.029837824	3438.233618	3626.105373	1.813052686
	Johnson	0.000286058	7.322112154	0.000526868	0.396381687	0.000211267	0	0.000843297	3.062551359	0.000353404	16.38963767	0.000101999	1.867338584	0.002742835	0	0.010978701	0	0.000112645	0.129780379	0.000512745	59.08393672	88.25173856	0.044125869
	Kaufman	0.006325453	161.9098051	0.006379446	4.799487271	0.004671629	0	0.010562096	38.3577242	0.002765	128.2311379	0.000911441	16.68608752	0.009011105	0	0.031317452	0	0.010715411	12.34546025	0.057545265	6630.9817	6993.311403	3.496655701
	Parker	0.000217489	5.566981877	0.000400576	0.301367914	0.000160626	0	0.000641157	2.328449436	0.000268692	12.46099677	7.75498E-05	1.419732426	0.00208537	0	0.008347076	0	8.56434E-05	0.098671668	0.000389838	44.92135575	67.09755584	0.033548778
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.000819895	20.98648722	0.000826893	0.622101782	0.000605529	0	0.001369042	4.971866208	0.000358395	16.62111282	0.00011814	2.162823693	0.001168005	0	0.004059317	0	0.001388914	1.600198603	0.007458924	859.4971295	906.4617199	0.45323086
	Hood	0.01252711	320.6508812	0.012634039	9.505044007	0.009251829	0	0.020917482	75.96475123	0.005475887	253.9526704	0.001805044	33.04561243	0.017845854	0	0.062021991	0	0.021221112	24.4493081	0.113964315	13132.18878	13849.75705	6.924878523
	Hunt	0.006187558	158.3801895	0.006240374	4.694858985	0.004569788	0	0.010331844	37.5215301	0.002704724	125.4357135	0.000891572	16.32233268	0.008814664	0	0.030634735	0	0.010481817	12.0763306	0.056290785	6486.427041	6840.857996	3.420428998
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.033413751	855.276978	0.051775843	38.95283667	0.024677545	0	0.090663423	329.2568536	0.001141841	52.95463998	1.143571754	20935.7914	0.046873844	0	0.004669544	0	0.000519582	0.598622181	0.002503865	288.5221599	22501.3535	11.25067675
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.002000467	51.20507169	0.076378745	57.46248772	0.001477434	0	0.133848731	486.0903138	0.001237133	57.37392999	0.003554796	65.07897116	0.001061766	0	0.001855699	0	0.000401718	0.462828487	0.001835165	211.4673431	929.140946	0.464570473
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.004502334	115.2442433	0.171901148	129.3274415	0.003325174	0	0.301245466	1094.014881	0.002784342	129.1281298	0.008000571	146.4694129	0.002389654	0	0.004176513	0	0.000904124	1.041660856	0.004130298	475.937112	2091.162881	1.04558144
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.002458599	62.93167289	0.093870431	70.62211537	0.001815785	0	0.164501762	597.4110691	0.001520452	70.51327681	0.004368889	79.98286869	0.001304924	0	0.002280677	0	0.000493717	0.568821994	0.00225544	259.8960069	1141.925832	0.570962916
	Travis	0.000510007	13.05442349	0.299602906	225.4020851	0.000376663	0	0.033939476	123.2559365	0.000334709	15.52263338	0.000906121	16.58869273	0.000271138	0	0.000471744	0	0.000103327	0.119045148	0.000467336	53.85143207	447.7942484	0.223897124
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.000685965	17.55833805	0.00069182	0.520481264	0.000506616	0	0.001145408	4.159710327	0.000299851	13.90604891	9.88414E-05	1.809525774	0.000977211	0	0.003396227	0	0.001162035	1.338805667	0.006240507	719.0980079	758.3909179	0.379195459
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	5824.975938	0.004556851	3.428283791	0.168069652	0	0.007612767	27.64682441	0.001680888	77.95375313	0.001626796	29.78235622	0.046792036	0	0.007246366	0	0.001609426	1.854254911	0.008283395	954.5014455	6920.142856	3.460071428
	San Patricio	0.050313351	1287.848557	0.001007478	0.757961986	0.037158653	0	0.001683113	6.112458369	0.000371629	17.2348572	0.00035967	6.584604794	0.010345288	0	0.001602105	0	0.000355829	0.409958691	0.001831382	211.0314828	1529.979881	0.76498994
Victoria Area	Victoria	0.021836736	558.9452467	0.002215582	1.666862472	0.016127403	0	0.003612695	13.12000619	0.001199621	55.63426979	0.000555389	10.16770824	0.52545648	0	0.032412721	0	0.000476855	0.549395481	0.002254849	259.8278678	899.9113567	0.449955678
Other ERCOT counties	Andrews	2.47421E-05	0.633312124	2.49533E-05	0.018773251	1.82731E-05	0	4.13138E-05	0.150036693	1.08153E-05	0.501577618	3.56511E-06	0.065267829	3.5247E-05	0	0.000122499	0	4.19135E-05	0.048289414	0.000225089	25.93716362	27.35442055	0.01367721
	Angelina	0.00031082	7.955919749	0.000313473	0.235837079	0.000229554	0	0.000519	1.884820844	0.000135867	6.301018286	4.47864E-05	0.81992053	0.000442787	0	0.001538876	0	0.000526534	0.606630902	0.002827658	325.8330045	343.6371519	0.171818576
	Bosque	0.000595392	15.23997933	0.001096604	0.825014503	0.000439723	0	0.001755208	6.374283599	0.000735562	34.11279889	0.000212298	3.88661097	0.005708837	0	0.02285067	0	0.000234455	0.270120186	0.001067208	122.9751683	183.6839758	0.091841988
	Brazos	0.001939725	49.65028649	0.003572622	2.687812467	0.001432574	0	0.005718288	20.7667609	0.002396384	111.1359931	0.000691644	12.66217912	0.018598805	0	0.074445136	0	0.000763829	0.880023807	0.003476855	400.6404605	598.4235164	0.299211758
	Calhoun	0.082699809	2116.830355	0.001655986	1.245858399	0.061077496	0	0.002766524	10.04701783	0.000610844	28.32885022	0.000591187	10.8230826	0.0170045	0	0.002633372	0	0.000584875	0.673847089	0.003010234	346.8714129	2514.820424	1.257410212
	Cameron	0.048371747	1238.150172	0.000968599	0.728712051	0.297964476	0	0.001618161	5.876577133	0.000357288	16.56975992	0.00034579	6.330503314	0.009946061	0	0.001540279	0	0.000342098	0.394138287	0.001760709	202.8877272	1470.93759	0.735468795
	Cherokee	0.003503899	89.68774747	0.003533808	2.658611083	0.002587786	0	0.00585073	21.24774271	0.001531635	71.03190513	0.00050488	9.243032581	0.00499158	0	0.017347879	0	0.005935657	6.838600793	0.031876422	3673.14266	3873.8503	1.93692515
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.001298787	33.24447222	2.6007E-05	0.019566001	0.000959212	0	4.34478E-05	0.157786761	9.59321E-06	0.444899929	9.2845E-06	0.16997473	0.000267053	0	4.13567E-05	0	9.18536E-06	0.010582658	4.72752E-05	5.447558433	39.49484073	0.01974742
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.003535748	90.50296541	0.003565928	2.682776563	0.002611307	0	0.005903911	21.44087434	0.001545556	71.67755054	0.00050947	9.327047245	0.005036951	0	0.017505563	0	0.00598961	6.900760344	0.032166163	3706.529738	3909.061712	1.954530856
	Fannin	0.007056315	180.6173605	0.007116546	5.354034748	0.005211403	0	0.011782473	42.78969328	0.003084477	143.0473568	0.001016752	18.61404924	0.010052276	0	0.034935966	0	0.011953503	13.77189259	0.064194222	7397.14566	7801.340048	3.900670024
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.003677178	94.12308402	0.003708565	2.790087625	0.00271576	0	0.006140067	22.29850932	0.001607379	74.54465257	0.000529848	9.700129134	0.005238429	0	0.018205785	0	0.006229194	7.176790757	0.033452809	3854.790927	4065.42418	2.03271209
	Frio	0.008588335	219.8317964	0.000871383	0.655572927	0.006342868	0	0.001420864	5.160066298	0.000471808	21.88082203	0.000218433	3.998934744	0.206660746	0	0.012747844	0	0.000187546	0.216075897	0.000886827	102.189664	353.9329323	0.176966466
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.188527456	4825.653746	0.003775086	2.840133709	0.139235931	0	0.006306735	22.9037859	0.001392518	64.58015017	0.001347706	24.6729498	0.03876448	0	0.006003193	0	0.001333316	1.536142338	0.006862311	790.7489276	5732.935836	2.866467918
	Howard	0.000555113	14.20898268	0.000559851	0.421196428	0.000409976	0	0.000926915	3.366221326	0.000242653	11.25338899	7.99868E-05	1.464348181	0.000790802	0	0.002748377	0	0.00094037	1.083420679	0.005050094	581.9258697	613.723428	0.306861714
	Jack	0.002121449	54.30177924	0.002139557	1.609665938	0.001566784	0	0.003542346	12.86452461	0.000927334	43.00653033	0.000305682	5.596228347	0.00302217	0	0.010503338	0	0.003593766	4.140456206	0.019299698	2223.917843	2345.437027	1.172718514
	Jones	0.040718722	1042.259088	0.000815354	0.613420549	0.030072592	0	0.001362147	4.946827986	0.00030076	13.94821343	0.000291082	5.32893728	0.008372468	0	0.001296587	0	0.000287974	0.331780603	0.001482142	170.7883116	1238.216579	0.61910829
	Lamar	0.000950838	24.33817497	0.000958954	0.721455757	0.000702236	0	0.001587687	5.765907769	0.000415633	19.27561996	0.000137007	2.508241656	0.001354543	0	0.004707619	0	0.001610734	1.855761432	0.008650166	996.7647898	1051.229951	0.525614976
	Limestone	0.000719757	18.42329542	0.000891528	0.670728366	0.000531572	0	0.000300183	1.090156782	0.00545518	252.9923553	0.001239347	22.68917849	0.000497945	0	0.00031596	0	0.000380962	0.438914787	0.000523179	60.28629516	356.5909243	0.178295462
	Llano	0.001238174	31.69299001	0.047274044	35.56597012	0.000914447	0	0.082844655	300.8619059	0.000765714	35.51115798	0.002200214	40.28013466	0.000657172	0	0.001148571	0	0.000248641	0.286464175	0.001135861	130.8861051	575.0847279	0.287542364
	McLennan	0.024534317	627.9940467	0.024743738	18.61560781	0.018119687	0	0.040966843	148.7767984	0.010724513	497.3657473	0.003535175	64.71975936	0.034951066	0	0.121469933	0	0.041561501	47.88391622	0.22319886	25719.36288	27124.71876	13.56235938
	Milam	0.002245405	57.4746346	0.002264571	1.703718789	0.001658332	0	0.003749326	13.61619935	0.000981518	45.51940379	0.000323543	5.923216216	0.003198756	0	0.011117048	0	0.00380375	4.382383245	0.02042738	2353.86146	2482.481016	1.241240508
	Mitchell	0.014943169	382.493668	0.015070721	11.3382478	0.011036196	0	0.024951762	90.61580067	0.006532002	302.9316123	0.002153177	39.41900132	0.02128772	0	0.07398395	0	0.025313952	29.16475857	0.135944204	15664.94698	16520.91007	8.260455036
	Nolan	0.000564654	14.45319062	0.000569473	0.428435476	0.000417022	0	0.000942846	3.424076134	0.000246823	11.44679952	8.13615E-05	1.489515743	0.000804394	0	0.002795613	0	0.000956532	1.102041289	0.005136889	591.9273539	624.2714127	0.312135706
	Palo Pinto	0.003206998	82.08811543	0.005906709	4.443830552	0.002368511	0	0.009454195	34.33422818	0.003962005	183.7440401	0.001143513	20.93471146	0.030749889	0	0.123082087	0	0.001262858	1.454966345	0.005748375	662.3893373	989.3892293	0.494694615
	Pecos	4.09677E-05	1.048631523	4.13174E-05	0.031084551	3.02565E-05	0	6.84069E-05	0.248429171	1.79079E-05	0.830506919	5.90308E-06	0.108069782	5.83617E-05	0	0.000202832	0	6.93999E-05	0.079957102	0.0003727	42.94648142	45.29316047	0.02264658
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.000737708	18.88277792	0.000835096	0.628273174	0.00054483	0	0.000735917	2.67258533	0.003149678	146.0711407	0.000730875	13.38040458	0.00076086	0	0.001866305	0	0.191632518	220.7840225	0.003397737	391.5236901	793.9428943	0.396971447
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.005696437	145.8091831	0.005745061	4.322217039	0.004207073	0	0.009511781	34.54335843	0.002490043	115.4795873	0.000820806	15.02679093	0.008115023	0	0.028203184	0	0.00964985	11.11780398	0.051822854	5971.584145	6297.883086	3.148941543
	Tom Green	0.001482448	37.94556586	2.96846E-05	0.022332825	0.001094854	0	4.95918E-05	0.180099353	1.09498E-05	0.507813132	1.05974E-05	0.19401082	0.000304817	0	4.72049E-05	0	1.04843E-05	0.012079149	5.39604E-05	6.217896494	45.07979763	0.022539899
	Upton	3.11661E-05	0.797745539	3.14322E-05	0.023647546	2.30176E-05	0	5.20405E-05	0.188992281	1.36234E-05	0.631807433	4.49076E-06	0.082213995	4.43986E-05	0	0.000154304	0	5.27959E-05	0.060827297	0.000283531	32.67149923	34.45673333	0.017228367
	Ward	0.018559529	475.0600294	0.01871795	14.08218954	0.013707039	0	0.030990277	112.54551	0.008112796	376.2433542	0.002674262	48.95869786	0.026439509	0	0.091888626	0	0.03144012	36.22285079	0.16884373	19455.98267	20519.0953	10.25954765
	Webb	0.020014327	512.2978652	0.000400768	0.301512399	0.014781473	0	0.000669531	2.431496589	0.000147832	6.855915242	0.000143074	2.619313398	0.004115289	0	0.000637307	0	0.000141547	0.163078928	0.000728512	83.94696529	608.6161471	0.304308074
	Wharton	0.00014434	3.694599265	0.000178787	0.134507561	0.000106601	0	6.01986E-05	0.218619544	0.001093979	50.7349716	0.000248538	4.550077512	9.98576E-05	0	6.33625E-05	0	7.6398E-05	0.088019771	0.000104918	12.08978615	71.5105814	0.035755291
	Wichita	0.000207633	5.314695266	0.000209406	0.157543345	0.000153346	0	0.000346701	1.259093698	9.07612E-05	4.209191786	2.99181E-05	0.547721432	0.00029579	0	0.001027996	0	0.000351734	0.405240184	0.001888925	217.6622165	229.5557022	0.114777851
	Wilbarger	0.028616818	732.4920115	0.000573025	0.431107444	0.021134796	0	0.000957307	3.476594279	0.000211372	9.802701684	0.00020457	3.745137877	0.005884109	0	0.000911232	0	0.000202386	0.233172965	0.001041639	120.0287677	870.2094935	0.435104747
	Wise	0.002844488	72.80908734	0.002882008	2.16823872	0.002100781	0	0.00476997	17.32281236	0.001256075	58.25242144	0.000413241	7.565361234	0.004181914	0	0.014614274	0	0.004797945	5.527817073	0.025761411	2968.505674	3132.151412	1.566075706
	Young	0.006235856	159.6164509	0.006289085	4.731505443	0.004605458	0	0.010412491	37.81441029	0.002725836	126.4148216	0.000898531	16.44973921	0.008883468	0	0.030873859	0	0.010563634	12.17059429	0.056730171	6537.057865	6894.255386	3.447127693
	Total	**1.121837219**	**28715.17018**	**1.172570094**	**882.1668247**	**1.090766584**	**0**	**1.189130767**	**4318.494059**	**1.629360006**	**75564.06999**	**1.542362643**	**28236.60382**	**1.359385821**	**0**	**1.231642808**	**0**	**1.221806085**	**1407.669558**	**1.528786947**	**176163.2035**	**315287.3779**	**157.643689**
Energy Savings by PCA (MWh)		25,597		752		0		3,632		46,377		18,307		0		0		1,152		115,231			

Table 65: Annual and OSD Electricity Savings for the Different Programs

PROGRAM	ANNUAL															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family (MWh)	225,389	1,001,051	1,197,537	1,256,764	1,252,530	1,280,624	1,306,878	1,331,121	1,353,183	1,372,892	1,390,077	1,404,569	1,416,195	1,424,785	1,430,169	1,432,174
ESL-Multifamily (MWh)	9,228	37,821	51,312	63,156	165,765	265,891	362,247	454,747	543,309	627,848	708,280	784,522	856,489	924,098	987,265	1,045,906
ESL-Commercial (MWh)	63,456	129,063	192,036	231,649	270,392	308,184	344,944	380,592	415,047	448,228	480,055	510,445	539,320	566,597	592,196	616,037
Federal Buildings (MWh)	52,276	109,073	159,415	206,960	251,708	293,659	332,813	369,171	402,732	433,496	461,464	486,635	509,009	528,586	545,366	559,350
Furnace Pilot Light Program (MMBtu)	2,209,050	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904
PUC (SB7) (MWh)	302,192	1,362,701	1,630,383	2,003,432	2,336,446	2,585,544	2,815,265	3,025,606	3,216,569	3,388,154	3,540,360	3,673,187	3,786,636	3,880,707	3,955,399	4,010,712
PUC (SB5 grant program) (MWh)	0	13,633	12,827	12,021	11,215	10,409	9,603	8,797	7,991	7,186	6,380	5,574	4,768	3,962	3,156	2,350
SECO (MWh)	115,360	293,764	353,701	445,357	457,921	468,611	477,428	484,371	489,440	492,636	493,959	493,408	490,983	486,685	480,513	472,468
Wind-ERCOT (MWh)	2,867,049	6,699,696	9,193,504	15,171,518	18,808,351	24,210,883	24,773,552	25,523,777	26,296,721	27,093,073	27,913,540	28,758,854	29,629,768	30,527,055	31,451,515	32,403,970
SEER13-Single Family (MWh)	0	374,246	624,639	913,010	1,185,311	1,441,594	1,681,860	1,906,108	2,114,339	2,306,551	2,482,746	2,642,923	2,787,083	2,915,224	2,803,568	2,590,509
SEER13-Multifamily (MWh)	0	31,634	52,532	76,375	98,620	119,281	138,371	155,904	171,894	186,354	199,298	210,738	220,690	229,165	219,722	202,900
Total Annual (MWh)	3,634,950	10,052,682	13,467,886	20,380,242	24,838,259	30,984,680	32,242,961	33,640,194	35,011,225	36,356,418	37,676,159	38,970,855	40,240,941	41,486,864	42,468,869	43,336,376
Total Annual (MMBtu)	2,209,050	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904

PROGRAM	OZONE SEASON DAY - OSD															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family (MWh)	776	5,537	6,519	6,904	6,981	7,335	7,488	7,630	7,759	7,875	7,977	8,063	8,133	8,185	8,219	8,234
ESL-Multifamily (MWh)	36	192	271	351	829	1,340	1,825	2,291	2,738	3,163	3,569	3,953	4,315	4,656	4,974	5,270
ESL-Commercial (MWh)	0	800	1,189	1,447	1,700	1,966	2,205	2,436	2,660	2,876	3,082	3,280	3,467	3,645	3,811	3,967
Federal Buildings (MWh)	0	299	437	567	690	805	912	1,011	1,103	1,188	1,264	1,333	1,395	1,448	1,494	1,532
Furnace Pilot Light Program (MMBtu)	5,819	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983
PUC (SB7) (MWh)	828	3,733	4,467	5,489	6,401	7,084	7,713	8,289	8,813	9,283	9,700	10,064	10,374	10,632	10,837	10,988
PUC (SB5 grant program) (MWh)	0	37	35	33	31	29	26	24	22	20	17	15	13	11	9	6
SECO (MWh)	316	805	969	1,220	1,255	1,284	1,308	1,327	1,341	1,350	1,353	1,352	1,345	1,333	1,316	1,294
Wind-ERCOT (MWh)	5,836	14,936	20,763	25,575	41,403	51,190	52,380	53,966	55,600	57,284	59,019	60,806	62,648	64,545	66,499	68,513
SEER13-Single Family (MWh)	0	2,666	4,449	6,503	8,442	10,268	11,979	13,576	15,059	16,428	17,683	18,824	19,851	20,764	19,969	18,451
SEER13-Multifamily (MWh)	0	213	354	514	664	803	931	1,049	1,157	1,254	1,341	1,418	1,485	1,542	1,479	1,365
Total OSD (MWh)	7,792	29,218	39,453	48,603	68,396	82,104	86,767	91,599	96,252	100,721	105,005	109,108	113,026	116,761	118,607	119,620
Total OSD (MMBtu)	5,819	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983

Table 66: Annual and OSD NOx Emissions Reduction Values for the Different Programs

PROGRAM	ANNUAL (in tons NOx)															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family	158	708	843	883	879	898	916	932	947	960	971	980	988	993	996	997
ESL-Multifamily	6	26	35	44	119	187	254	317	378	436	491	543	593	639	682	722
ESL-Commercial	44	90	136	164	192	218	245	270	295	319	341	363	384	403	421	438
Federal Buildings	40	84	122	158	193	225	255	283	308	332	353	373	390	405	418	428
Furnace Pilot Light Program	102	117	117	117	117	117	117	117	117	117	117	117	0	0	0	0
PUC (SB7)	237	1,074	1,157	1,421	1,633	1,779	1,913	2,035	2,144	2,242	2,327	2,400	2,461	2,510	2,547	2,950
PUC (SB5 grant program)	0	6	5	5	5	4	4	4	3	3	3	2	2	2	1	1
SECO	67	224	270	340	349	357	364	369	373	376	377	376	374	371	366	360
Wind-ERCOT	2,465	4,152	5,688	8,914	10,957	14,047	14,373	14,808	15,257	15,719	16,195	16,685	17,191	17,711	18,248	18,800
SEER13-Single Family	0	258	430	629	816	993	1,158	1,313	1,456	1,589	1,710	1,820	1,920	2,008	1,931	1,784
SEER13-Multifamily	0	22	36	53	68	82	95	107	118	128	137	145	152	158	151	140
Total Annual (Tons NOx)	3,119	6,761	8,839	12,728	15,328	18,907	19,694	20,555	21,396	22,221	23,022	23,804	24,455	25,200	25,761	26,620

PROGRAM	OZONE SEASON DAY - OSD (in tons NOx/day)															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family	0.76	3.85	4.50	4.76	4.81	5.05	5.15	5.24	5.32	5.40	5.46	5.52	5.56	5.59	5.61	5.62
ESL-Multifamily	0.03	0.13	0.18	0.24	0.58	0.93	1.26	1.57	1.87	2.15	2.43	2.69	2.93	3.16	3.37	3.57
ESL-Commercial	0.26	0.55	0.82	1.00	1.17	1.36	1.52	1.68	1.84	1.98	2.13	2.26	2.39	2.52	2.63	2.74
Federal Buildings	0.11	0.22	0.32	0.42	0.51	0.59	0.67	0.74	0.81	0.87	0.93	0.98	1.02	1.06	1.10	1.12
Furnace Pilot Light Program	0.28	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.00	0.00	0.00	0.00
PUC (SB7)	0.64	2.61	3.10	3.81	4.38	4.78	5.14	5.47	5.77	6.03	6.26	6.46	6.63	6.76	6.86	6.93
PUC (SB5 grant program)	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
SECO	0.18	0.61	0.73	0.92	0.95	0.97	0.99	1.00	1.01	1.02	1.02	1.02	1.02	1.01	0.99	0.98
Wind-ERCOT	5.85	9.27	12.98	15.13	24.35	30.04	30.74	31.67	32.63	33.62	34.64	35.68	36.77	37.88	39.03	40.21
SEER13-Single Family	0.00	1.81	3.03	4.42	5.74	6.98	8.15	9.23	10.24	11.17	12.03	12.80	13.50	14.12	13.58	12.55
SEER13-Multifamily	0.00	0.15	0.24	0.35	0.45	0.55	0.63	0.71	0.79	0.85	0.91	0.97	1.01	1.05	1.01	0.93
Total OSD (Tons NOx)	8.11	19.54	26.24	31.38	43.27	51.58	54.58	57.64	60.61	63.42	66.14	68.71	70.84	73.15	74.18	74.65

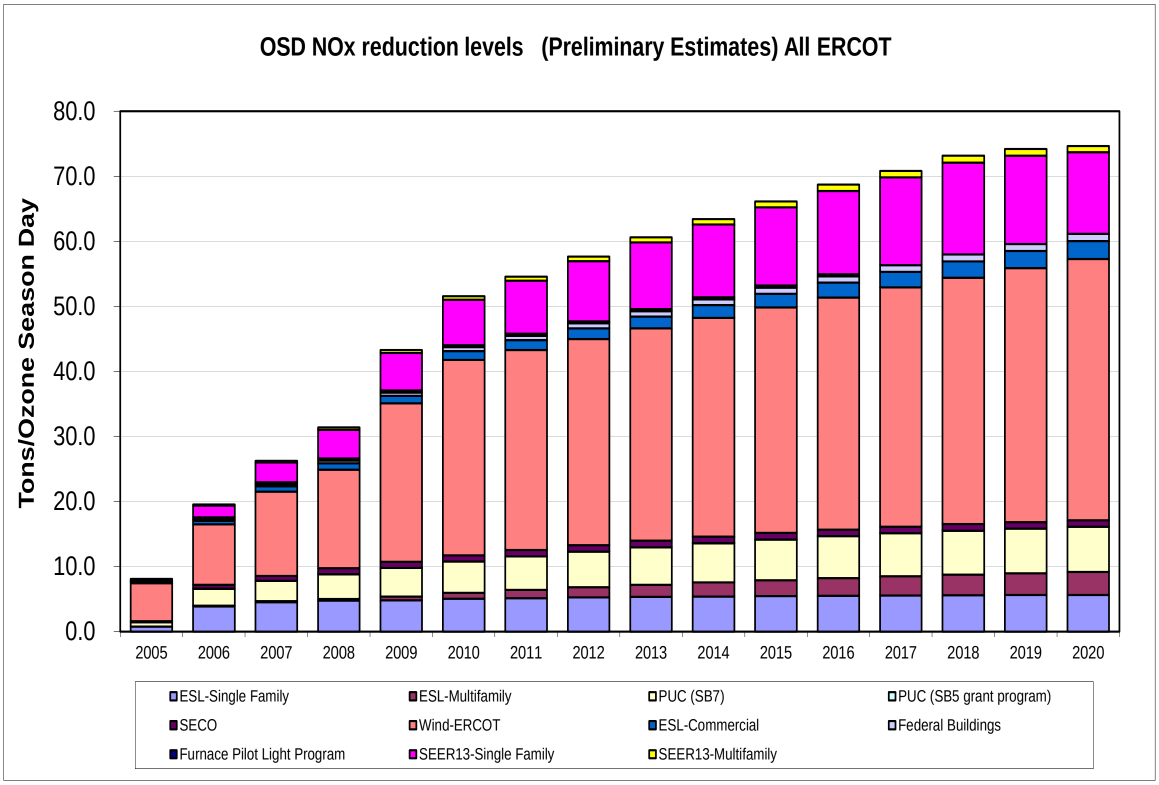

Figure 173: Cumulative OSD NOx Emissions Reduction Projections through 2020

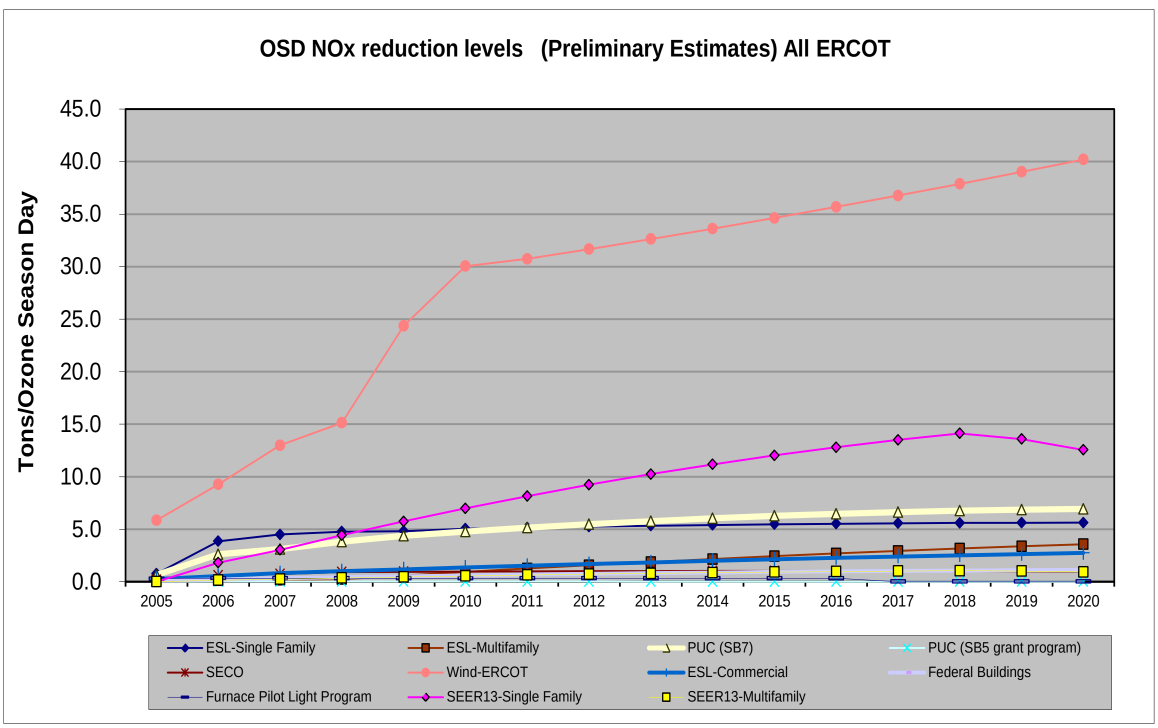

Figure 174: Cumulative OSD NOx Emissions Reduction Projections through 2020

8.5 Weather Data

In order to calculate the NOx emissions from energy efficiency and renewable energy (EE/RE) projects in non-attainment and affected counties in Texas, several weather data sets needed to be assembled from the many different weather sources (Figure 67 and Figure 68), including hourly weather data sets needed for the DOE-2 simulations and daily average weather data for analysis that used monthly utility billing data. In 2008 these sources were updated.

In the archive the counties were grouped according to the nearest TMY2 weather station. Next, for each group, weather files were determined for F-CHART, PV F-CHART, ASHRAE 90.1-1989, and ASHRAE 90.1-1999 analysis. Finally, as shown in Table 53, weather files were assigned for NOAA data (temperature, humidity, wind speed) and NREL (solar radiation). In some instances, where solar radiation data were not available from the NREL database, TCEQ solar data were used. For NREL solar sources, solar data included global horizontal, direct normal beam, and diffuse solar radiation. For TCEQ solar sources, only global horizontal solar radiation data were available which required synthesis of direct normal beam and diffuse radiation using an iterative kt procedure (Erbs 1982). Synthetic beam and diffuse solar data were also used to fill missing NREL data.

In 2005, at the request of the TCEQ, the nine weather stations assembled for calculating emissions from the non-attainment and affected counties were expanded to include all counties in ERCOT. To accomplish this, 8 additional weather stations were added to the original 9 stations for a total of 17 weather stations (Table 54). Assignment of weather stations was then performed as shown in Table 55, with additional details provided in Table 56. Figure 69 shows an updated map of Texas showing the available weather files, 2000/2001 IECC weather zones, and ERCOT county outline. Figure 70 shows the clustering of the counties around their chosen TMY2 and NOAA weather stations. Figure 71 shows the 2000/2001 and 2006 IECC weather zones and available weather files. During the period from July 2008 to August 2009, the Laboratory maintained and added additional years of weather data to the archive.

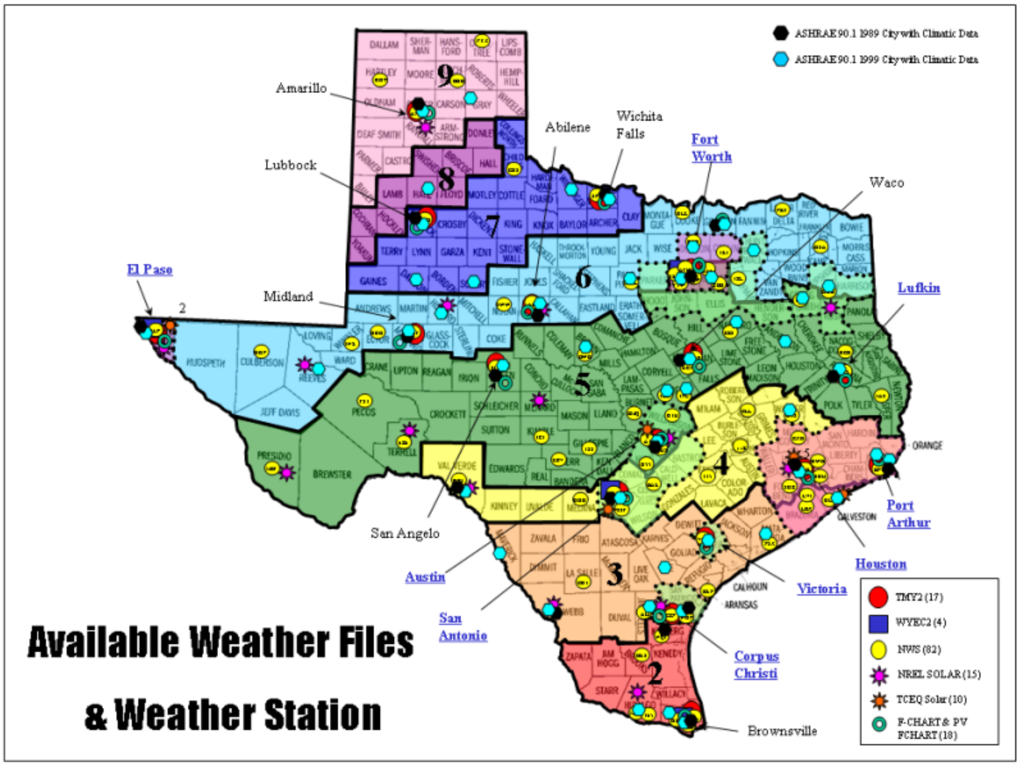

Figure 175: Available Weather Stations in Texas for 41 Non-attainment and Affected Counties

List of Available Weather Files and Weather Stations of Texas

Texas Weather Stations (NOAA)

1	Abilene Regional Airport (ABI)
2	Alice International Airport (ALI)
3	Amarillo International Airport (AMA)
4	Angleton / Lake Jackson Brazoria (LBX)
5	Arlington Municipal Airport (GKY)
6	Austin - Bergstrom International (AUS)
7	Austin Camp Mabry (ATT)
8	Borger Hutchinson County Airport (BGD)
9	BRENHAM: BRENHAM MUNICIPAL AIRPORT (11R)
10	Brownsville S Padre Isl International (BRO)
11	BROWNWOOD: BROWNWOOD REGIONAL AIRPORT (BWD)
12	Burnet Municipal Airport (BMQ)
13	Childress Municipal Airport (CDS)
14	College Station (CLL)
15	Conroe Montgomery County Airport (CXO)
16	Corpus Christi International Airport (CRP)
17	CORPUS CHRISTI: CORPUS CHRISTI NAS/TRUAX FIELD ARPT (NGP)
18	Corsicana Campbell Field (CRS)
19	Cotulla La Salle Co Airport (COT)
20	Dalhart Municipal Airport (DHT)
21	Dallas - Fort Worth International Airport (DFW)
22	Dallas Love Field (DAL)
23	Dallas Redbird Airport (RBD)
24	Del Rio International Airport (DRT)
25	Denton Municipal Airport (DTO)
26	Dryden Terrell County Airport (6R6)
27	El Paso International Airport (ELP)
28	FALFURRIAS: BROOKS COUNTY AIRPORT (BKS)
29	Fort Stockton Pecos County Airport (FST)
30	Fort Worth Alliance Airport (AFW)
31	Fort Worth Meacham (FTW)
32	FREDERICKSBURG: GILLESPIE COUNTY AIRPORT (T82)
33	GAINESVILLE: GAINESVILLE MUNICIPAL AIRPORT (GLE)
34	Galveston Scholes Field (GLS)
35	GEORGETOWN: GEORGETOWN MUNICIPAL AIRPORT (GTU)
36	Harlingen Rio Grande Valley I (HRL)
37	Hondo Municipal Airport (HDO)
38	Houston Bush Intercontinental (IAH)
39	Houston Clover Field (LVJ)
40	Houston Hooks Memorial Airport (DWH)
41	Houston Sugarland Mem (SGR)
42	Houston William P Hobby Airport (HOU)
43	Huntsville Municipal Airport (UTS)
44	JASPER: JASPER COUNTY-BELL FIELD AIRPORT (JAS)
45	Junction Kimble County Airport (JCT)
46	KERRVILLE: KERRVILLE MUNI/LOUIS SCHREINER FLD AIRPORT (ERV)
47	KILLEEN: KILLEEN MUNICIPAL AIRPORT (ILE)
48	KINGSVILLE: KINGSVILLE NAS AIRPORT (NQI)
49	LA GRANGE: FAYETTE REGIONAL AIR CENTER AIRPORT (3T5)
50	Longview E Tx Rgnl Airport (GGG)
51	Lubbock International Airport (LBB)
52	Lufkin Angelina Cty Airport (LFK)
53	MARFA: MARFA MUNICIPAL AIRPORT (MRF)
54	McAllen Miller International Airport (MFE)
55	McKinney Municipal Airport (TKI)
56	Midland International Airport (MAF)
57	Mineral Wells Airport (MWL)
58	MOUNT PLEASANT: MOUNT PLEASANT REGIONAL AIRPORT (OSA)
59	NACOGDOCHES: A L MANGHAM JR REGIONAL AIRPORT (OCH)
60	New Braunfels Municipal Airport (BAZ)
61	Odessa Schlemeyer Field (ODO)
62	Palacios Municipal Airport (PSX)
63	PARIS: COX FIELD AIRPORT (PRX)
64	PERRYTON: PERRYTON OCHILTREE COUNTY AIRPORT (PYX)
65	Pine Springs Guadalupe Mounta (GDP)
66	Port Arthur Se Tx Rgnl Airport (BPT)
67	Port Isabel Cameron County Airport (PIL)
68	Rockport Aransas Co Airport (RKP)
69	San Angelo Mathis Field (SJT)
70	San Antonio International Airport (SAT)
71	San Antonio Stinson Municipal Airport (SSF)
72	SAN MARCOS: SAN MARCOS MUNICIPAL AIRPORT (HYI)
73	SWEETWATER: AVENGER FIELD AIRPORT (SWW)
74	TEMPLE: DRAUGHON-MILLER CNTRL TEXAS REGIONAL ARPT (TPL)
75	Terrell Municipal Airport (TRL)
76	Tyler Pounds Field (TYR)
77	Victoria Regional Airport (VCT)
78	WACO: MC GREGOR EXECUTIVE AIRPORT (PWG)
79	Waco Regional Airport (ACT)
80	WESLACO: MID VALLEY AIRPORT (T65)
81	Wichita Falls Municipal Airport (SPS)
82	Wink Winkler Co Airport (INK)

Texas TMY2 Weather Files

1	Abilene
2	Amarillo
3	Austin
4	Brownsville
5	Corpus Christi
6	El Paso
7	Fort Worth
8	Houston
9	Lubbock
10	Lufkin
11	Midland
12	Port Arthur
13	San Angelo
14	San Antonio
15	Victoria
16	Waco
17	Wichita Falls

Texas WYEC2 Weather Files

1	El Paso
2	Brownsville
3	Fort Worth
4	San Antonio

NREL Solar Stations

1	Abilene
2	Austin
3	Big Spring
4	Canyon
5	Clear Lake
6	Corpus Christi
7	Del Rio
8	Edinburg
9	El Paso
10	Laredo
11	Menard
12	Overton
13	Pecos
14	Presidio
15	Sanderson

TCEQ Solar Stations

1	Bexar
2	Travis
3	El Paso (2)
4	Galveston
5	Harris (5)

FCHART and PV FCHART (New Weather File)

1	ABILENE
2	AMARILLO
3	AUSTIN
4	BROWNSVILLE
5	CORPUS CHRISTI
6	EL PASO
7	FORT WORTH
8	HOUSTON
9	LUBBOCK
10	LUFKIN
11	MIDLAND-ODESSA
12	PORT ARTHUR
13	SAN ANGELO
14	SAN ANTONIO
15	SHERMAN
16	VICTORIA
17	WACO
18	WICHITA FALLS

Table 67: Assignment of Weather Stations for 41 Non-attainment and Affected Counties (NOAA, TMY2, F-CHART, PV F-CHART, NAHB, Climate Zone, HDD, CDD, 90.1-1989, 90.1-1999)

Area	No.	County	NOAA Weather Station		Solar Station		TMY2		FCHART		PV-FCHART		DOE Include File	Weather File	DOE TRY weather file name	East or West Texas	Climate Zone	HDD		CDD		AHSRAE 90.1-1989		AHSRAE 90.1-1999		County
			WBAN No.	Weather Station	Source	File	WBAN No.	File										1989	1999	1989	1999	Nearest City	Table 8A (10, 12, 16)	Nearest City	Table B (5, 6, 8, 10)	
	ID	County	WBAN No.	Weather Station	x	x	x	TMY2File	Fchart	FchartID	PVFChart	PVFChartID	DOE_INC	x	DOE_WF	PRECODE	CZ									County
Austin	22	Bastrop	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	BAS	Austin	ATT	West	4					Austin	12	Austin	6	Bastrop
	26	Caldwell	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	CAL	Austin	ATT	West	4					Austin	12	Austin	6	Caldwell
	8	Hays	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	HAY	Austin	ATT	West	5					Austin	12	Austin	6	Hays
	40	Travis	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	TRA	Austin	ATT	West	5	1735	1688	6873	7171	Austin	12	Austin	6	Travis
	41	Williamson	13958	Austin Camp Mabry (ATT)	NREL	Austin	13958	Austin	Austin	14	Austin	18	WLL	Austin	ATT	West	5					Austin	12	Kileen/Robert-gray or **Austin**	6	Williamson
Corpus	38	Nueces	12924	Corpus Christi International Airport (CRP)	NREL	Corpus Christi	12924	Corpus Christi	Corpus Christi	52	Corpus Christi	58	NUE	Corpus Christi	CRP	East	3	889	1016	8200	8023	Corpus Christi	16	Corpus Christi or Alice	5	Nueces
	15	San Patricio	12924	Corpus Christi International Airport (CRP)	NREL	Corpus Christi	12924	Corpus Christi	Corpus Christi	52	Corpus Christi	58	SAP	Corpus Christi	CRP	East	3					Corpus Christi	16	Corpus Christi or Alice	5	San Patricio
El Paso	30	El Paso	23044	El Paso International Airport (ELP)	TCEQ	C12-El Paso UTEP	23044	El Paso	El Paso	68	El Paso	70	ELP	El Paso	ELP	West	6	2605	2708	5617	5488	El Paso	12	El Paso	10	El Paso
Dallas-Ft. Worth	27	Collin	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	COL	Fort Worth	DFW	West	6					Sherman or Fort Worth	12	**Denton**, Greenville or Sherman	8	Collin
	4	Dallas	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	DAL	Fort Worth	DFW	West	5		2259		6587	Fort Worth	12	Dallas	8	Dallas
	29	Denton	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	DEN	Fort Worth	DFW	West	6					Shermanor Fort Worth	12	Denton	8	Denton
	31	Ellis	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	ELL	Fort Worth	DFW	West	5					Fort Worth	12	Fort Worth, Dallas or Corsicana	8	Ellis
	23	Hood	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	HOD	Fort Worth	DFW	West	5					Fort Worth	12	Mineral Wells or Fort Worth	8	Hood
	24	Hunt	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	HNT	Fort Worth	DFW	West	6					Shermanor Fort Worth	12	Greenville	10	Hunt
	36	Johnson	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	JOH	Fort Worth	DFW	West	5					Fort Worth	12	Mineral Wells or Fort Worth	8	Johnson
	10	Kaufman	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	KAU	Fort Worth	DFW	West	6					Fort Worth	12	Greenville, **Dallas** or Corsicana	8	Kaufman
	39	Parker	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	PAR	Fort Worth	DFW	West	6					Fort Worth	12	Mineral Wells or Fort Worth	8	Parker
	13	Rockwall	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	ROC	Fort Worth	DFW	West	6					Shermanor Fort Worth	12	**Dallas** or Greeenville	8	Rockwall
	17	Tarrant	03927	Dallas - Fort Worth International Airpor (DFW)	NREL	Overton	03927	Fort Worth	Fort Worth	78	Fort Worth	83	TAR	Fort Worth	DFW	West	5	2354		6174		Fort worth	12	Fort worth	8	Tarrant
Houston/Galveston	2	Brazoria	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	BRA	Houston	IAH	East	3					Houston	10	Houston, Galveston or Bay City	5	Brazoria
	5	Fort Bend	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	FOB	Houston	IAH	East	4					Houston	10	Houston or Bay City	5	Fort Bend
	32	Galveston	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	GAL	Houston	IAH	East	3		1263		7378	Houston	10	Galveston	5	Galveston
	34	Harris	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	HAR	Houston	IAH	East	4	1346	1371	7125	7357	Houston	10	Houston	5	Harris
	37	Montgomery	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	MOG	Houston	IAH	East	4					Houston	10	Huntsville or **Houston**	5	Montgomery
	20	Waller	12960	Houston Bush Intercontinental (IAH)	NREL	Clear Lake	12960	Houston	Houston	96	Houston	102	WAL	Houston	IAH	East	4					Houston	10	Houston	5	Waller
Tyler/Longview	33	Gregg	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	GRE	Lufkin	GGG	East	6					Lufkin	12	Longview	8	Gregg
	35	Harrison	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	HAN	Lufkin	GGG	East	6					Lufkin	12	Longview	8	Harrison
	9	Henderson	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	HDS	Lufkin	GGG	East	5					Lufkin, Waco or Fort Worth	12	Tyler, Palestine or Corsicana	8	Henderson
	14	Rusk	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	RUS	Lufkin	GGG	East	5					Lufkin	12	Tyler or Longview	8	Rusk
	16	Smith	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	SMI	Lufkin	GGG	East	5		1296		6562	Lufkin	12	Tyler	8	Smith
	18	Upshur	03901	Longview E Tx Rgnl Airport (GGG)	NREL	Overton	93987	Lufkin	Lufkin	125	Lufkin	131	UPS	Lufkin	GGG	East	6					Lufkin	12	Tyler or Longview	8	Upshur
Beaumont Pt. Arthur	3	Chambers	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	CHA	Port Arthur	BPT	East	4					Houston or Port Arthur	10	Beaumont or **Houston**	5	Chambers
	7	Hardin	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	HAD	Port Arthur	BPT	East	4					Port Arthur	10	Beaumont	6	Hardin
	25	Jefferson	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	JEF	Port Arthur	BPT	East	4	1416	1677	6888	6703	Port Arthur	10	Beaumont	6	Jefferson
	11	Liberty	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	LIB	Port Arthur	BPT	East	4					Houston or Port Arthur	10	Beaumont, Galveston or **Houston**	5	Liberty
	12	Orange	12917	Port Arthur Se Tx Rgnl Airport (BPT)	TCEQ	C34-Galveston Airport	12917	Port Arthur	Port Arthur	166	Port Arthur	172	ORA	Port Arthur	BPT	East	4					Port Arthur	10	Beaumont	6	Orange
San Antonio	1	Bexar	12921	San Antonio International Airport (SAT)	TCEQ	C58-Camp Bullis	12921	San Antonio	San Antonio	187	San Antonio	194	BEX	San Antonio	SAT	West	4	1579	1644	7170	7142	San Antonio	12	San Antonio	6	Bexar
	28	Comal	12921	San Antonio International Airport (SAT)	TCEQ	C58-Camp Bullis	12921	San Antonio	San Antonio	187	San Antonio	194	COM	San Antonio	SAT	West	4					San Antonio	12	San Antonio	6	Comal
	6	Guadalupe	12921	San Antonio International Airport (SAT)	TCEQ	C58-Camp Bullis	12921	San Antonio	San Antonio	187	San Antonio	194	GUA	San Antonio	SAT	West	4					San Antonio	12	San Antonio	6	Guadalupe
	21	Wilson	12921	San Antonio International Airport (SAT)	TCEQ	C58-Camp Bullis	12921	San Antonio	San Antonio	187	San Antonio	194	WIL	San Antonio	SAT	West	4					San Antonio	12	San Antonio	6	Wilson
Victoria	19	Victoria	12912	Victoria Regional Airport (VCT)	TCEQ	C58-Camp Bullis	12912	Victoria	Victoria	347	Victoria	225	VIC	Victoria	VCT	East	3	Hou	1296	Hou	7507			Victoria	5	Victoria

Table 68: Availability of Weather Data for 41 Non-attainment and Affected County (NOAA, NREL, TCEQ, ESL)

County No.	County	Affected = A Non Attain = N Others = 0	WBAN No.	NOAA	Lat. Deg.	Lat. Min.	Long. Deg.	Long. Min.	Elev. (m)	Station No.	NREL	Lat. Deg.	Lat. Min.	Long. Deg.	Long. Min.	Elev. (m)
1	Bastrop	A														
2	Bexar	A	12921	San Antonio International Airport (SAT)	N 29	32	W 98	28	246.3							
2	Bexar	A	12970	San Antonio Stinson Municipal Airport (SSF)	N 29	20	W 98	28	175.3							
3	Caldwell	A														
4	Comal	A														
5	Ellis	A														
5	Ellis	A														
6	Gregg	A	13901	Longview E Tx Rgnl Airport (GGG)	N 32	23	W 94	43	111.3							
7	Guadalupe	A	12971	New Braunfels Municipal Airport (BAZ)	N 29	43	W 98	3	196.3							
8	Harrison	A														
9	Hays	A	-	SAN MARCOS : SAN MARCOS MUNICIPAL AIRPORT (HYI)	-	-	-	-	-							
10	Johnson	A														
11	Kaufman	A	53911	Terrell Municipal Airport (TRL)	N 32	43	W 96	16	144.3							
12	Nueces	A	12924	Corpus Christi International Airport (CRP)	N 27	46	W 97	31	12.5	6	Corpus Christi					
12	Nueces	A	-	CORPUS CHRISTI : CORPUS CHRISTI NAS/TRUAX FIELD ARPT (NGP)	-	-	-	-	-							
13	Parker	A														
14	Rockwall	A														
15	Rusk	A								12	Overton					
16	San Patricio	A														
17	Smith	A	13972	Tyler Pounds Field (TYR)	N 32	21	W 95	24	165.0							
18	Travis	A	13904	Austin - Bergstrom International (AUS)	N 30	11	W 97	41	146.3	2	Austin					
18	Travis	A	13958	Austin Camp Mabry (ATT)	N 30	19	W 97	46	200.3							
18	Travis	A														
19	Upshur	A														
20	Victoria	A	12912	Victoria Regional Airport (VCT)	N 28	52	W 96	56	35.1							
21	Williamson	A	-	GEORGETOWN : GEORGETOWN MUNICIPAL AIRPORT (GTU)	-	-	-	-	-							
22	Wilson	A														
23	Henderson	A														
24	Hood	A														
25	Hunt	A														
26	Brazoria	N	12976	Angleton / Lake Jackson Brazori (LBX)	N 29	7	W 95	28	76.0							
26	Brazoria	N	12975	Houston Clover Field (LVJ)	N 29	31	W 95	15	13.4							
27	Chambers	N														
28	Collin	N	53914	McKinney Municipal Airport (TKI)	N 33	11	W 96	35	176.3							
28	Collin	N														
29	Dallas	N	33006	Dallas Love Field (DAL)	N 32	51	W 96	51	134.1							
29	Dallas	N	03971	Dallas Redbird Airport (RBD)	N 32	41	W 96	52	200.3							
29	Dallas	N														
30	Denton	N	03991	Denton Municipal Airport (DTO)	N 33	12	W 97	12	195.7							
31	El Paso	N	23044	El Paso International Airport (ELP)	N 31	49	W 106	23	1194.2	9	El Paso					
31	El Paso	N														
31	El Paso	N														
32	Fort Bend	N	12977	Houston Sugarland Mem (SGR)	N 29	37	W 95	39	25.0							
33	Galveston	N	12923	Galveston Scholes Field (GLS)	N 29	16	W 94	52	1.5							
34	Hardin	N														
35	Harris	N	12960	Houston Bush Intercontinental (IAH)	N 29	59	W 95	22	29.0	5	Clear Lake					
35	Harris	N	53910	Houston Hooks Memorial Airport (DWH)	N 30	4	W 95	33	46.3							
35	Harris	N	12918	Houston William P Hobby Airport (HOU)	N 29	38	W 95	17	13.4							
35	Harris	N														
35	Harris	N														
35	Harris	N														
35	Harris	N														
35	Harris	N														
35	Harris	N														
35	Harris	N														
35	Harris	N														
36	Jefferson	N	12917	Port Arthur Se Tx Rgnl Airport (BPT)	N 29	57	W 94	1	4.9							
36	Jefferson	N														
36	Jefferson	N														
36	Jefferson	N														
37	Liberty	N														
38	Montgomery	N	53902	Conroe Montgomery County Airport (CXO)	N 30	21	W 95	25	74.7							
39	Orange	N														
40	Tarrant	N	53907	Arlington Municipal Airport (GKY)	N 32	40	W 97	6	192.0							
40	Tarrant	N	03927	Dallas - Fort Worth International Airpor (DFW)	N 32	54	W 97	1	170.7							
40	Tarrant	N	53909	Fort Worth Alliance Airport (AFW)	N 32	58	W 97	19	208.3							
40	Tarrant	N	13961	Fort Worth Meacham (FTW)	N 32	49	W 97	22	209.4							
40	Tarrant	N														
41	Waller	N														

County No.	County	CAMS No.	TCEQ	Lat. Deg.	Lat. Min.	Long. Deg.	Long. Min.	Elev. (m)	Site No.	ESL	Lat. Deg.	Lat. Min.	Long. Deg.	Long. Min.	Elev. (m)
1	Bastrop														
2	Bexar	C58	Camp Bullis	N 29	38	W 98	34		140	UTHSC					
2	Bexar														
3	Caldwell														
4	Comal														
5	Ellis	C30	El Paso East	N 31	45	W 106	29								
5	Ellis	C94	Midlothian Tower	N 32	26	W 97	1								
6	Gregg														
7	Guadalupe														
8	Harrison														
9	Hays														
10	Johnson	C77	Cleburne Airport	N 32	21	W 97	26								
11	Kaufman	C71	Kaufman	N 32	34	W 96	19								
12	Nueces	C4	Corpus Christi West	N 27	46	W 97	26								
12	Nueces														
13	Parker	C76	Parker County (Fort Worth)	N 32	52	W 97	54								
14	Rockwall	C69	Rockwall Heath	N 32	56	W 96	26								
15	Rusk														
16	San Patricio														
17	Smith	C02	Tyler Airport relocated	N 32	21	W 95	25								
18	Travis	C38	Austin Audubon Society	N 30	29	W 97	52		202	S.F. Austin Building (SFA)					
18	Travis								217	Robert E. Johnson Elec Rcom. (West Solar)					
18	Travis								217	Robert E. Johnson Elec Rcom. (South Solar)					
19	Upshur														
20	Victoria	C87	Victoria	N 28	50	W 97	0								
21	Williamson														
22	Wilson														
23	Henderson														
24	Hood	C73	Granbury	N 32	27	W 97	48								
25	Hunt	C1006	Greenville	N 33	9	W 96	7								
26	Brazoria	C1015	Lake Jackson	N 29	3	W 95	28								
26	Brazoria														
27	Chambers														
28	Collin	C31	Frisco C31	N 33	8	W 96	47								
28	Collin	C68	Anna	N 33	21	W 96	33								
29	Dallas	C63	Dallas North #2 (Dallas)	N 32	55	W 96	48		794	Federal Reserve - Weather Station (FRW)					
29	Dallas	C74	Sunnyvale Long Creek (Dallas)	N 32	46	W 96	33								
29	Dallas	C401	Dallas Hinton St	N 32	49	W 96	52								
30	Denton	C56	Denton Airport South	N 33	12	W 97	12								
31	El Paso	C12	El Paso UTEP	N 31	46	W 106	30		325	Valle Verde Campus (ECV)					
31	El Paso	C37	Ascarate Park SE	N 31	45	W 106	24								
31	El Paso	C41	El Paso Chamizal	N 31	46	W 106	27								
32	Fort Bend														
33	Galveston	C34	Galveston Airport	N 29	16	W 94	51								
34	Hardin														
35	Harris	C8	Aldine	N 29	54	W 95	20		121	UT Health Science Center					
35	Harris	C15	Channelview	N 29	48	W 95	8		931	Habitat Humanity Houses					
35	Harris	C26	Northwest Harris County	N 30	2	W 95	40								
35	Harris	C35	Deer Park #2	N 29	40	W 95	8								
35	Harris	C45	Seabrook Friendship Park	N 29	35	W 95	1								
35	Harris	C53	Houston Bayland Park	N 29	42	W 95	30								
35	Harris	C81	Houston Regional Office	N 29	44	W 95	19								
35	Harris	C85	Karnack	N 32	40	W 94	10								
35	Harris	C403	Clinton (CEC, Houston)	N 29	44	W 95	15								
35	Harris	C617	Wallisville Road	N 29	49	W 94	59								
35	Harris	C1015	Lynchburg Ferry	N 29	46	W 95	5								
36	Jefferson	C20	Port Arthur West	N 29	54	W 93	58								
36	Jefferson	C2	Beaumont Downtown	N 30	2	W 94	4								
36	Jefferson	C64	Hamshire	N 29	52	W 94	19								
36	Jefferson	C643	SETRPC 43 Jefferson County Airport	N 29	57	W 94	0	0							
37	Liberty														
38	Montgomery	C78	Conroe Airport Relocated	N 30	21	W 95	25								
39	Orange	C9	West Orange	N 30	5	W 93	46								
40	Tarrant	C61	Arlington Municipal Airport	N 32	39	W 97	5		111	University Hall (UT Arlington)					
40	Tarrant	C70	Grapevine Fairway	N 32	59	W 97	4								
40	Tarrant	C13	Fort Worth Northwest	N 32	48	W 97	21								
40	Tarrant	C17	Keller (Fort Worth)	N 32	55	W 97	17								
40	Tarrant	C75	Eagle Mountain Lake (Fort Worth)	N 32	59	W 97	29								
41	Waller														

County No.	County	WBAN No.	TMY2	Latitude Deg.	Latitude Min.	Longitude Deg.	Longitude Min.	Elev. (m)	NOAA 99	NOAA 00	NOAA 01	NOAA 02	NOAA 03	NREL 99	NREL 00	NREL 01	NREL 02	NREL 03	TCEQ 99	TCEQ 00	TCEQ 01	TCEQ 02	TCEQ 03	ESL 99	ESL 00	ESL 01	ESL 02	ESL 03
1	Bastrop	13958	Austin	N 30	18	W 97	42	189																				
2	Bexar	12921	San Antonio	N 29	32	W 98	28	242	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Bexar	12922	San Antonio	N 29	32	W 98	28	242	Y	Y	Y	Y	Y															
3	Caldwell	13958	Austin	N 30	18	W 97	42	189																				
4	Comal	12923	San Antonio	N 29	32	W 98	28	242																				
5	Ellis	03936	Fort Worth	N 32	50	W 97	3	164											Y									
5	Ellis	03937	Fort Worth	N 32	50	W 97	3	164												Y	Y	Y	Y					
6	Gregg	93987	Lufkin	N 31	14	W 94	45	96	Y	Y	Y	Y	Y															
7	Guadalupe	12924	San Antonio	N 29	32	W 98	28	242	Y	Y	Y	Y	Y															
8	Harrison	93988	Lufkin	N 31	14	W 94	45	96																				
9	Hays	93989	Lufkin	N 31	14	W 94	45	96				Y	Y															
10	Johnson	03930	Fort Worth	N 32	50	W 97	3	164														Y	Y					
11	Kaufman	03939	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y							Y	Y	Y	Y					
12	Nueces	12924	Corpus Christi	N 27	46	W 97	30	13	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y	Y					
12	Nueces	12924	Corpus Christi	N 27	46	W 97	30	13	Y	Y	Y	Y	Y															
13	Parker	03940	Fort Worth	N 32	50	W 97	3	164														Y	Y					
14	Rockwall	03941	Fort Worth	N 32	50	W 97	3	164														Y	Y					
15	Rusk	93987	Lufkin	N 31	14	W 94	45	96						Y	Y	Y	Y	Y										
16	San Patricio	12924	Corpus Christi	N 27	46	W 97	30	13																				
17	Smith	93900	Lufkin	N 31	14	W 94	45	90	Y	Y	Y	Y	Y									Y	Y					
18	Travis	93990	Lufkin	N 31	14	W 94	45	96	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
18	Travis	93991	Lufkin	N 31	14	W 94	45	96	Y	Y	Y	Y	Y													Y	Y	Y
18	Travis	93992	Lufkin	N 31	14	W 94	45	96																		Y	Y	Y
19	Upshur	93989	Lufkin	N 31	14	W 94	45	96																				
20	Victoria	12912	Victoria	N 28	51	W 96	55	32	Y	Y	Y	Y	Y									Y	Y					
21	Williamson	93993	Lufkin	N 31	14	W 94	45	96				Y	Y															
22	Wilson	12925	San Antonio	N 29	32	W 98	28	242																				
23	Henderson																											
24	Hood																					Y	Y					
25	Hunt																						Y					
26	Brazoria	12960	Houston	N 29	59	W 95	22	33	Y	Y	Y	Y	Y										Y					
26	Brazoria	12960	Houston	N 29	59	W 95	22	33	Y	Y	Y	Y	Y															
27	Chambers	12917	Port Arthur	N 29	57	W 94	1	7																				
28	Collin	03937	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y									Y	Y					
28	Collin	03938	Fort Worth	N 32	50	W 97	3	164														Y	Y					
29	Dallas	03927	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y									Y	Y				Y	Y
29	Dallas	03928	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y									Y	Y					
29	Dallas	03929	Fort Worth	N 32	50	W 97	3	164											Y	Y	Y	Y	Y					
30	Denton	03942	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y							Y	Y	Y	Y					
31	El Paso	23044	El Paso	N 31	48	W 106	24	1194	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
31	El Paso	23045	El Paso	N 31	48	W 106	24	1194												Y	Y	Y	Y					
31	El Paso	23046	El Paso	N 31	48	W 106	24	1194											Y	Y	Y	Y	Y					
32	Fort Bend	12969	Houston	N 29	59	W 95	22	33		Y	Y	Y	Y															
33	Galveston	12960	Houston	N 29	59	W 95	22	33	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y					
34	Hardin	12918	Port Arthur	N 29	57	W 94	1	7																				
35	Harris	12960	Houston	N 29	59	W 95	22	33	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
35	Harris	12960	Houston	N 29	59	W 95	22	33	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y	Y	Y
35	Harris	12960	Houston	N 29	59	W 95	22	33	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y					
35	Harris	12961	Houston	N 29	59	W 95	22	33											Y	Y	Y	Y	Y					
35	Harris	12962	Houston	N 29	59	W 95	22	33														Y	Y					
35	Harris	12963	Houston	N 29	59	W 95	22	33											Y	Y	Y	Y	Y					
35	Harris	12964	Houston	N 29	59	W 95	22	33														Y	Y					
35	Harris	12965	Houston	N 29	59	W 95	22	33														Y	Y					
35	Harris	12966	Houston	N 29	59	W 95	22	33											Y	Y	Y	Y	Y					
35	Harris	12967	Houston	N 29	59	W 95	22	33											-	-	-	-	-					
35	Harris	12968	Houston	N 29	59	W 95	22	33															Y					
36	Jefferson	12919	Port Arthur	N 29	57	W 94	1	7	Y	Y	Y	Y	Y									Y	Y					
36	Jefferson	12920	Port Arthur	N 29	57	W 94	1	7														Y	Y					
36	Jefferson	12921	Port Arthur	N 29	57	W 94	1	7														Y	Y					
36	Jefferson	12922	Port Arthur	N 29	57	W 94	1	7											Y	Y	Y	Y	Y					
37	Liberty	12923	Port Arthur	N 29	57	W 94	1	7																				
38	Montgomery	12970	Houston	N 29	59	W 95	22	33	Y	Y	Y	Y	Y									Y	Y					
39	Orange	12924	Port Arthur	N 29	57	W 94	1	7														Y	Y					
40	Tarrant	03931	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y									Y	Y	Y	Y	Y	Y	Y
40	Tarrant	03932	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y							Y	Y	Y	Y					
40	Tarrant	03933	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y							Y	Y	Y	Y					
40	Tarrant	03934	Fort Worth	N 32	50	W 97	3	164	Y	Y	Y	Y	Y									Y	Y					
40	Tarrant	03935	Fort Worth	N 32	50	W 97	3	164														Y	Y					
41	Waller	12971	Houston	N 29	59	W 95	22	33																				

Note:

County No. The affected and non attainment county numbers are listed orderly using table 19, p. 101, of the TERP Technical Report 2003.
The other county numbers are listed alphabetically.

NOAA WBAN No. Station's Weather Bureau Army Navy number
TMY2 WBAN No. Station's Weather Bureau Army Navy number
NREL Station No. The station numbers are listed alphabetically.
TECQ CAMS No. The numbers are from TECQ.
ESL Site No. ESL's site numbers.

Y in black: The whole years data is available
Y in red: The data is available for partial year

Table 69: Main NOAA Weather Stations used in eCALC

ABI	Abilene Regional Airport
AMA	Amarillo International Airport
BRO	Brownsville S. Padre Island International
LBB	Lubbock International Airport
MAF	Midland International Airport
SJT	San Angelo Mathis Field
ACT	Waco Regional Airport
SPS	Wichita Falls Municipal Airport
ATT	Austin Camp Mabry
BPT	Port Arthur Se TX Rgnl Airport
CRP	Corpus Christi International Airport
DFW	Dallas - Fort Worth International Airport
ELP	El Paso International Airport
GGG	Longview E TX Rgnl Airport
IAH	Houston Bush Intercontinental
SAT	San Antonio International Airport
VCT	Victoria Regional Airport

Table 70: Summary of Weather Data Assignments for ERCOT Counties

ERCOT COUNTY	ASSIGNED WEATHER STATION	ERCOT COUNTY	ASSIGNED WEATHER STATION	ERCOT COUNTY	ASSIGNED WEATHER STATION
ANDERSON	GGG	FRANKLIN	DFW	MIDLAND	MAF
ANDREWS	MAF	FREESTONE	ACT	MILAM	IAH
ANGELINA	GGG	FRIO	SAT	MILLS	ACT
ARANSAS	CRP	GALVESTON	IAH	MITCHELL	ABI
ARCHER	SPS	GILLESPIE	ATT	MONTAGUE	SPS
ATASCOSA	SAT	GLASSCOCK	MAF	MONTGOMERY	IAH
AUSTIN	IAH	GOLIAD	VCT	MOTLEY	LBB
BANDERA	SAT	GONZALES	SAT	NACOGDOCHES	GGG
BASTROP	ATT	GRAYSON	SPS	NAVARRO	ACT
BAYLOR	SPS	GRIMES	IAH	NOLAN	ABI
BEE	VCT	GUADALUPE	SAT	NUECES	CRP
BELL	ACT	HALL	AMA	PALO PINTO	ABI
BEXAR	SAT	HAMILTON	ACT	PARKER	DFW
BLANCO	ATT	HARDEMAN	SPS	PECOS	SJT
BORDEN	LBB	HARRIS	IAH	PRESIDIO	SJT
BOSQUE	ACT	HASKELL	ABI	RAINS	DFW
BRAZORIA	IAH	HAYS	ATT	REAGAN	MAF
BRAZOS	IAH	HENDERSON	DFW	REAL	ATT
BREWSTER	SJT	HIDALGO	BRO	RED RIVER	DFW
BRISCOE	AMA	HILL	ACT	REEVES	MAF
BROOKS	BRO	HOOD	DFW	REFUGIO	VCT
BROWN	ACT	HOPKINS	DFW	ROBERTSON	IAH
BURLESON	IAH	HOUSTON	GGG	ROCKWALL	DFW
BURNET	ATT	HOWARD	MAF	RUNNELS	SJT
CALDWELL	ATT	HUDSPETH	ELP	RUSK	GGG
CALHOUN	VCT	HUNT	SPS	SAN PATRICIO	CRP
CALLAHAN	ABI	IRION	SJT	SAN SABA	ATT
CAMERON	BRO	JACK	ABI	SCHLEICHER	SJT
CHAMBERS	BPT	JACKSON	VCT	SCURRY	LBB
CHEROKEE	GGG	JEFF DAVIS	MAF	SHACKELFORD	ABI
CHILDRESS	LBB	JIM HOGG	BRO	SMITH	DFW
CLAY	SPS	JIM WELLS	CRP	SOMERVELL	DFW
COKE	SJT	JOHNSON	DFW	STARR	BRO
COLEMAN	ABI	JONES	ABI	STEPHENS	ABI
COLLIN	DFW	KARNES	VCT	STERLING	SJT
COLORADO	IAH	KAUFMAN	DFW	STONEWALL	LBB
COMAL	SAT	KENDALL	SAT	SUTTON	SJT
COMANCHE	ACT	KENEDY	BRO	TARRANT	DFW
CONCHO	SJT	KENT	LBB	TAYLOR	ABI
COOKE	SPS	KERR	ATT	TERRELL	SJT
CORYELL	ACT	KIMBLE	SJT	THROCKMORTON	ABI
COTTLE	SPS	KING	LBB	TITUS	DFW
CRANE	MAF	KINNEY	SAT	TOM GREEN	SJT
CROCKETT	SJT	KLEBERG	CRP	TRAVIS	ATT
CROSBY	LBB	KNOX	SPS	UPTON	MAF
CULBERSON	ELP	LA SALLE	CRP	UVALDE	SAT
DALLAS	DFW	LAMAR	DFW	VAL VERDE	SAT
DAWSON	LBB	LAMPASAS	ACT	VAN ZANDT	DFW
DE WITT	VCT	LAVACA	VCT	VICTORIA	VCT
DELTA	DFW	LEE	ATT	WALLER	IAH
DENTON	DFW	LEON	ACT	WARD	MAF
DICKENS	LBB	LIMESTONE	ACT	WASHINGTON	IAH
DIMMIT	CRP	LIVE OAK	CRP	WEBB	CRP
DUVAL	CRP	LLANO	ATT	WHARTON	VCT
EASTLAND	ABI	LOVING	MAF	WICHITA	SPS
ECTOR	MAF	MADISON	IAH	WILBARGER	SPS
EDWARDS	SJT	MARTIN	MAF	WILLACY	BRO
ELLIS	DFW	MASON	ATT	WILLIAMSON	ATT
ERATH	ABI	MATAGORDA	VCT	WILSON	SAT
FALLS	ACT	MAVERICK	CRP	WINKLER	MAF
FANNIN	SPS	MCCULLOCH	SJT	WISE	DFW
FAYETTE	IAH	MCLENNAN	ACT	YOUNG	ABI
FISHER	ABI	MCMULLEN	CRP	ZAPATA	BRO
FOARD	SPS	MEDINA	SAT	ZAVALA	CRP
FORT BEND	IAH	MENARD	SJT		

Table 71: Assignment of NWS Weather Stations for all ERCOT Counties

No.	The City TMY2 Weather File is Available	County with TMY2 Weather Station					Adjacent Counties						Nearest Counties						
		County Name	Weather Zone	HDD	Table	Weather Station Assigned	No.	County Name	Weather Zone	HDD	Table	Weather Station Assigned	No.	County Name	Nearest Cities with TMY2 Files	Weather Zone	HDD	Table	Weather Station Assigned
1	Abilene	TAYLOR	6B	2584	B-8	ABI	1	CALLAHAN	6B			ABI	1	EASTLAND	Abilene (6B)	6B			ABI
							2	COLEMAN	5B			ABI	2	ERATH	Abilene (6B), Fort Worth (5B)	6B			ABI
							3	FISHER	6B			ABI	3	HASKELL	Abilene (6B), Wichita Falls (7B)	6B			ABI
							4	JONES	6B			ABI	4	JACK	Fort Worth (5B), Abilene (6B)	6B			ABI
							5	NOLAN	6B			ABI	5	MITCHELL	Abilene (6B), Midland (6B)	6B			ABI
							6	SHACKELFORD	6B			ABI	6	PALO PINTO	Fort Worth (5B), Abilene (6B)	6B	2025	B-8	ABI
													7	STEPHENS	Abilene (6B)	6B			ABI
													8	THROCKMORTON	Abilene (6B), Wichita Falls (7B)	6B			ABI
													9	YOUNG	Wichita Falls (7B), Abilene (6B), Fort Worth (5B)	6B			ABI
2	Amarillo	POTTER	9B	4258	B-13	AMA							10	BRISCOE	Amarillo (9B), Lubbock (7B)	8			AMA
													11	HALL	Amarillo (9B), Lubbock (7B)	8			AMA
3	Austin	TRAVIS	5B	1688	B-6	ATT	7	BASTROP	4B			ATT	12	GILLESPIE	San Antonio (4B), Austin (5B)	5A			ATT
							8	BLANCO	5A			ATT	13	KERR	San Antonio (4B), Austin (5B)	5A			ATT
							9	BURNET	5A			ATT	14	LEE	Austin (5B), Houston (4B)	4B			ATT
							10	CALDWELL	4B			ATT	15	LLANO	Austin (5B), San Antonio (4B),	5B			ATT
							11	HAYS	5B			ATT	16	MASON	Austin (5B), San Antonio (4B),	5B			ATT
							12	WILLIAMSON	5B			ATT	17	REAL	San Antonio (4B), Austin (5B), San Angelo (5B)	5A			ATT
													18	SAN SABA	Austin (5B), San Angelo (5B), Waco (5B)	5B			ATT
4	Brownsville	CAMERON	2B	635	B-3	BRO	13	HIDALGO	2B	778	B-3	BRO	19	BROOKS	Brownsville (2B), Corpus Christie (3B)	2B			BRO
							14	WILLACY	2B			BRO	20	JIM HOGG	Brownsville (2B), Corpus Christie (3B)	2B			BRO
													21	KENEDY	Brownsville (2B), Corpus Christie (3B)	2B			BRO
													22	STARR	Brownsville (2B)	2B			BRO
													23	ZAPATA	Brownsville (2B), Corpus Christie (3B)	2B			BRO
5	Corpus Christi	NUECES	3B	1016	B-5	CRP	15	ARANSAS	3B			CRP	24	DIMMIT	Corpus Christi (3B), San Anotonio (4B)	3C			CRP
							16	JIM WELLS	3C	1062	B-5	CRP	25	DUVAL	Corpus Christi (3B)	3C			CRP
							17	KLEBERG	2B			CRP	26	LA SALLE	Corpus Christi (3B)	3C			CRP
							18	SAN PATRICIO	3C			CRP	27	LIVE OAK	Corpus Christi (3B), Victoria (3B)	3C			CRP
													28	MAVERICK	San Anotonio (4B), Corpus Christi (3B)	3C	1441	B-5	CRP
													29	MCMULLEN	Corpus Christi (3B), Victoria (3B)	3C			CRP
													30	WEBB	Corpus Christi (3B)	3C	1025	B-5	CRP
													31	ZAVALA	San Anotonio (4B), Corpus Christi (3B)	3C			CRP
6	El Paso	EL PASO	6B	2708	B-10	ELP	19	HUDSPETH	6B			ELP	32	CULBERSON	El Paso (6B)	6B			ELP
7	Fort Worth	TARRANT	5B	2304	B-8	DFW	20	COLLIN	6B			DFW	33	DELTA	Fort Worth (5B)	6B			DFW
							21	DALLAS	5B	2259	B-8	DFW	34	FRANKLIN	Fort Worth (5B)	6B			DFW
							22	DENTON	6B	2665	B-8	DFW	35	HENDERSON	Fort Worth (5B), Lufkin (5A), Waco (5B)	5B			DFW
							23	ELLIS	5B			DFW	36	HOOD	Fort Worth (5B), Waco (5B)	5B			DFW
							24	JOHNSON	5B			DFW	37	HOPKINS	Fort Worth (5B)	6B			DFW
							25	PARKER	6B			DFW	38	KAUFMAN	Fort Worth (5B)	6B			DFW
							26	WISE	6B			DFW	39	LAMAR	Fort Worth (5B)	6B			DFW
													40	RAINS	Fort Worth (5B)	6B			DFW
													41	RED RIVER	Fort Worth (5B)	6B			DFW
													42	ROCKWALL	Fort Worth (5B)	6B			DFW
													43	SMITH	Fort Worth (5B), Lufkin (5A)	5B	2194	B-8	DFW
													44	SOMERVELL	Fort Worth (5B), Waco (5B)	5B			DFW
													45	TITUS	Fort Worth (5B)	6B			DFW
													46	VAN ZANDT	Fort Worth (5B)	6B			DFW
8	Houston	HARRIS	4B	1371	B-5	IAH	27	BRAZORIA	3B			IAH	47	AUSTIN	Houston (4B)	4B			IAH
							28	FORT BEND	4B			IAH	48	BRAZOS	Houston (4B), Austin (5B), Waco (5B)	4B			IAH
							29	GALVESTON	3B	1263	B-5	IAH	49	BURLESON	Austin (5B), Waco (5B), Houston (4B)	4B			IAH
							30	MONTGOMERY	4B			IAH	50	COLORADO	Houston (4B), Victoria (3B)	4B			IAH
							31	WALLER	4B			IAH	51	FAYETTE	Houston (4B), San Antonio (4B)	4B			IAH
													52	GRIMES	Houston (4B)	4B			IAH
													53	MADISON	Houston (4B), Waco (5B), Lufkin (5A)	4B			IAH
													54	MILAM	Austin (5B), Waco (5B), Houston (4B)	4B			IAH
													55	ROBERTSON	Waco (5B), Houston (4B)	4B			IAH
													56	WASHINGTON	Houston (4B), Austin (5B)	4B			IAH
9	Lubbock	LUBBOCK	7B	3431	B-11	LBB	32	CROSBY	7B			LBB	57	BORDEN	Lubbock (7B), Abilene (6B), Midland (6B)	7B			LBB
													58	CHILDRESS	Lubbock (7B), Wichita Falls (7B)	7B			LBB
													59	DAWSON	Lubbock (7B), Midland (6B)	7B	3159	B-11	LBB
													60	DICKENS	Lubbock (7B)	7B			LBB
													61	KENT	Lubbock (7B), Abilene (6B)	7B			LBB
													62	KING	Lubbock (7B), Abilene (6B), Wichita Falls (7B)	7B			LBB
													63	MOTLEY	Lubbock (7B)	7B			LBB
													64	SCURRY	Lubbock (7B), Midland (6B), Abilene (6B)	7B	3185	B-11	LBB
													65	STONEWALL	Abilene (6B), Lubbock (7B), Wichita Falls (7B)	7B			LBB
10	Lufkin	ANGELINA	5A	1951	B-8	GGG	33	CHEROKEE	5A			GGG	66	ANDERSON	Lufkin (5A)	5A	2005	B-8	GGG
							34	HOUSTON	5A			GGG	67	RUSK	Lufkin (5A)	5B			GGG
							35	NACOGDOCHES	5A			GGG	67						
11	Midland	MIDLAND	6B	2751	B-10	MAF	36	ANDREWS	6B			MAF	68	HOWARD	Midland (6B)	6B	2772	B-10	MAF
							37	CRANE	5B			MAF	69	JEFF DAVIS	Midland (6B), El Paso (6B)	6B			MAF
							38	ECTOR	6B			MAF	70	LOVING	Midland (6B)	6B			MAF
							39	GLASSCOCK	6B			MAF	71	REEVES	Midland (6B)	6B	2505	B-8	MAF
							40	MARTIN	6B			MAF	72	WARD	Midland (6B)	6B			MAF
							41	REAGAN	5B			MAF	73	WINKLER	Midland (6B)	6B			MAF
							42	UPTON	5B			MAF	73						
12	Port Arthur	JEFFERSON	4B	1677	B-6	BPT	43	CHAMBERS	4B			BPT	73						
13	San Angelo	TOM GREEN	5B	2414	B-8	SJT	44	COKE	6B			SJT	74	BREWSTER	El Paso (6B), San Angelo (5B)	5A			SJT
							45	CONCHO	5B			SJT	75	CROCKETT	San Angelo (5B)	5B			SJT
							46	IRION	5B			SJT	76	EDWARDS	San Angelo (5B)	5A			SJT
							47	MENARD	5B			SJT	77	KIMBLE	San Angelo (5B), Austin (5B)	5A			SJT
							48	RUNNELS	5B			SJT	78	MCCULLOCH	San Angelo (5B)	5B			SJT
							49	SCHLEICHER	5B			SJT	79	PECOS	San Angelo (5B)	5A			SJT
							50	STERLING	6B			SJT	80	PRESIDIO	El Paso (6B), San Angelo (5B)	5A			SJT
													81	SUTTON	San Angelo (5B)	5A			SJT
													82	TERRELL	San Angelo (5B)	5A			SJT
14	San Antonio	BEXAR	4B	1644	B-6	SAT	51	ATASCOSA	3C			SAT	83	FRIO	San Antonio (4B), Corpus Christi (3B)	3C			SAT
							52	BANDERA	5A			SAT	84	GONZALES	San Antonio (4B), Victoria (3B)	4B			SAT
							53	COMAL	4B			SAT	85	KINNEY	San Antonio (4B)	4B			SAT
							54	GUADALUPE	4B			SAT	86	UVALDE	San Antonio (4B)	4B			SAT
							55	KENDALL	5A			SAT	87	VAL VERDE	San Anotonio (4B), San Angelo (5B)	4B	1565	B-5	SAT
							56	MEDINA	4B			SAT	87						SAT
							57	WILSON	4B			SAT	87						
15	Victoria	VICTORIA	3B	1296	B-5	VCT	58	CALHOUN	3B			VCT	88	BEE	Corpus Christi (3B), Victoria (3B)	3B	1372	B-5	VCT
							59	DE WITT	3C			VCT	89	KARNES	Victoria (3B), San Antonio (4B), Corpus Christi (3B)	3C			VCT
							60	GOLIAD	3B			VCT	90	MATAGORDA	Victoria (3B)	3B	1370	B-5	VCT
							61	JACKSON	3B			VCT	91	WHARTON	Victoria (3B), Houston (4B)	3B			VCT
							62	LAVACA	4B			VCT	91						
							63	REFUGIO	3B			VCT	91						
16	Waco	MCLENNAN	5B	2179	B-8	ACT	64	BELL	5B	2127	B-8	ACT	92	BROWN	Abilene (6B), Waco (5B), San Angelo (5B)	5B	2199	B-8	ACT
							65	BOSQUE	5B			ACT	93	COMANCHE	Waco (5B), Abilene (6B)	5B			ACT
							66	CORYELL	5B			ACT	94	FREESTONE	Waco (5B)	5B			ACT
							67	FALLS	5B			ACT	95	HAMILTON	Waco (5B)	5B			ACT
							68	HILL	5B			ACT	96	LAMPASAS	Waco (5B), Austin (5B)	5B			ACT
							69	LIMESTONE	5B			ACT	97	LEON	Waco (5B), Lufkin (5A)	5B			ACT
													98	MILLS	Waco (5B), Austin (5B)	5B			ACT
													99	NAVARRO	Waco (5B), Fort Worth (5B)	5B	2396	B-8	ACT
17	Wichita Falls	WICHITA	7B	3042	B-10	SPS	70	ARCHER	7B			SPS	100	COOKE	Fort Worth (5B), Wichita Falls (7B)	6B			SPS
							71	BAYLOR	7B			SPS	101	COTTLE	Witchita Falls (7B), Lubbock (7B)	7B			SPS
							72	CLAY	7B			SPS	102	FANNIN	Fort Worth (5B), Wichita Falls (7B)	6B			SPS
							73	WILBARGER	7B	3186	B-10	SPS	103	FOARD	Witchita Falls (7B)	7B			SPS
													104	GRAYSON	Fort Worth (5B), Wichita Falls (7B)	6B	2890	B-10	SPS
													105	HARDEMAN	Witchita Falls (7B)	7B			SPS
													106	HUNT	Fort Worth (5B), Wichita Falls (7B)	6B	2953	B-10	SPS
													107	KNOX	Wichita Falls (7B)	7B			SPS
													108	MONTAGUE	Wichita Falls (7B), Fort Worth (5B)	6B			SPS

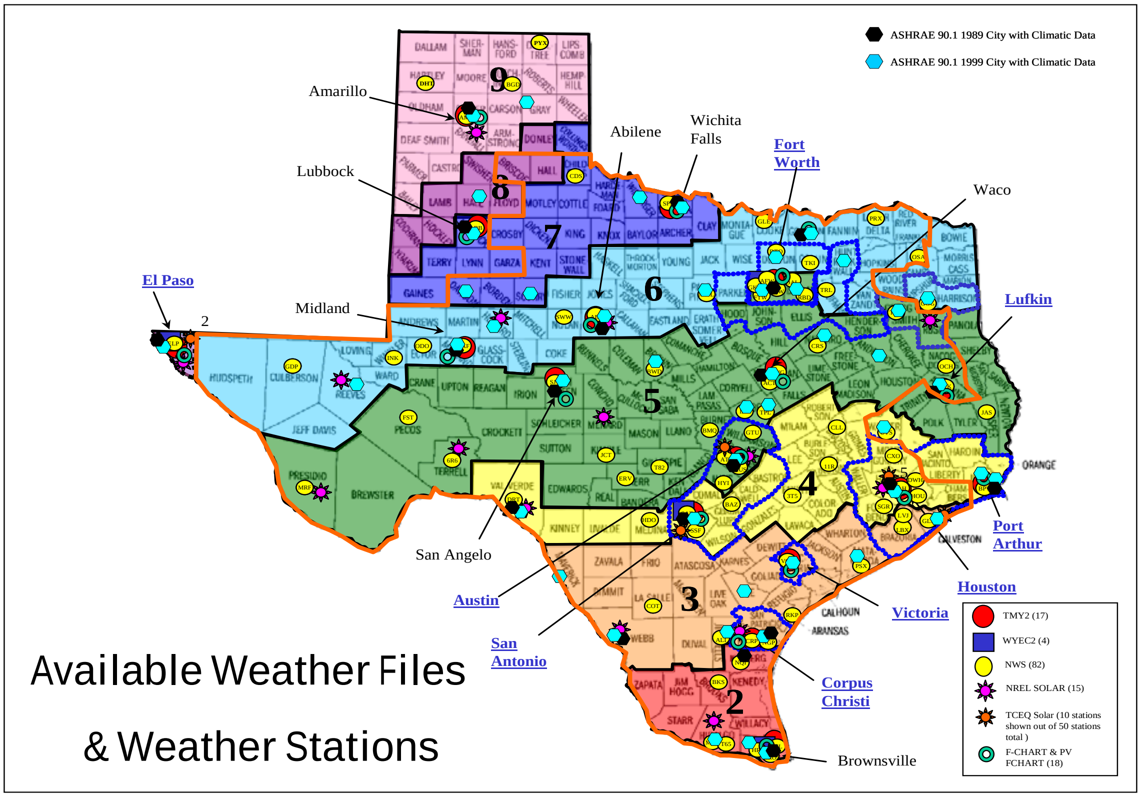

Figure 176: Available Weather Stations in Texas for all ERCOT Counties

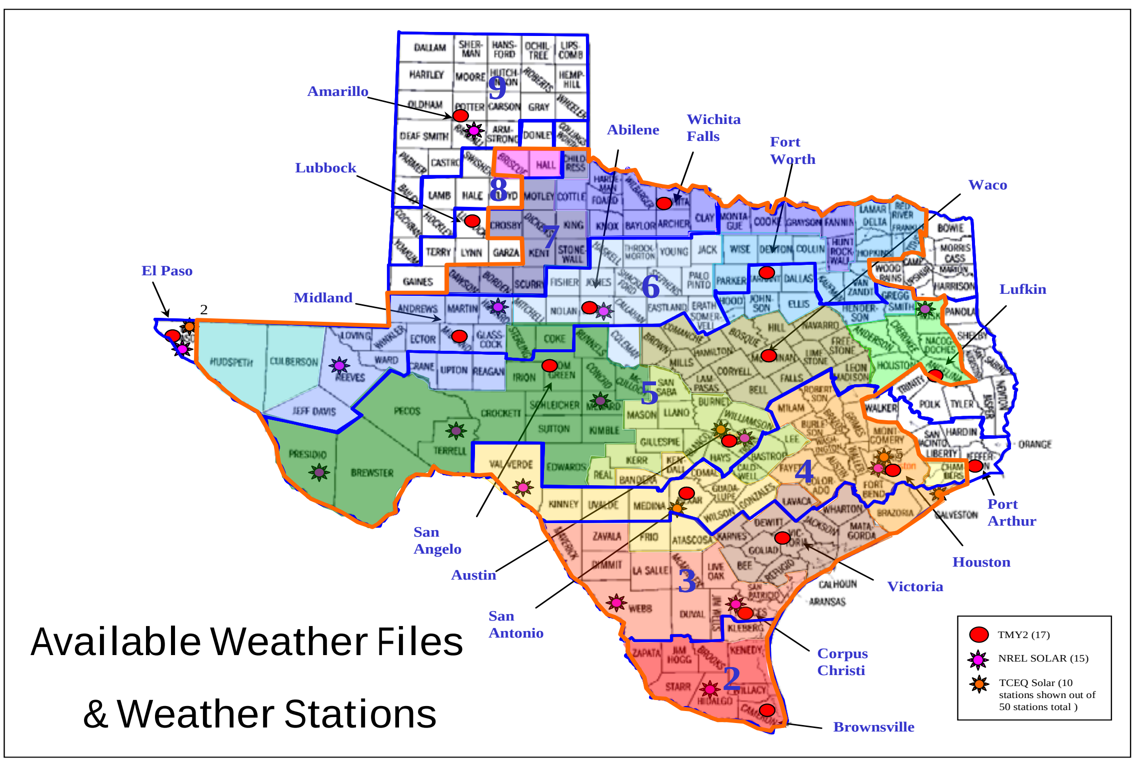

Figure 177: Grouping of Weather Stations in Texas for all ERCOT Counties

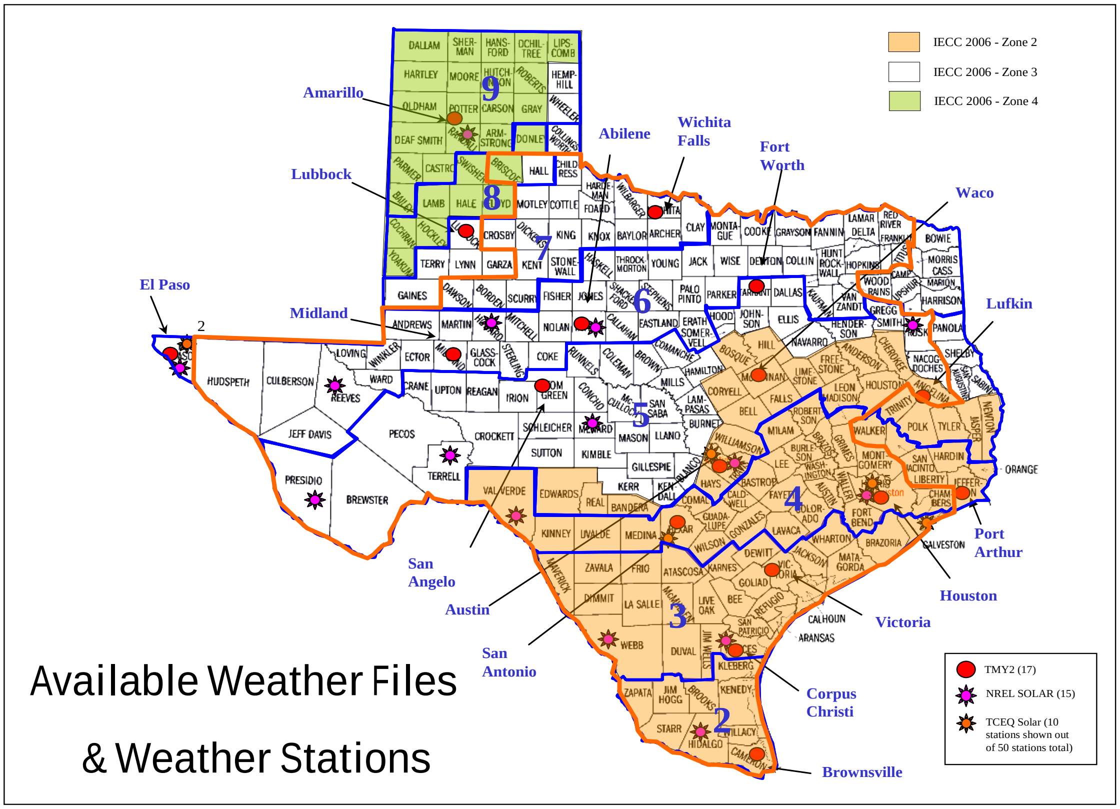

Figure 178: Available Weather Stations in Texas for all ERCOT Counties Showing 2000/2001 and 2006 Climate Zones

List of Available Weather Files and Weather Stations of Texas

Texas Weather Stations (NOAA)

1 Abilene Regional Airport (ABI)
2 Alice International Airport (ALI)
3 Amarillo International Airport (AMA)
4 Angleton / Lake Jackson Brazori (LBX)
5 Arlington Municipal Airport (GKY)
6 Austin - Bergstrom International (AUS)
7 Austin Camp Mabry (ATT)
8 Borger Hutchinson County Airport (BGD)
9 BRENHAM: BRENHAM MUNICIPAL AIRPORT (11R)
10 Brownsville S Padre Isl International (BRO)
11 BROWNWOOD: BROWNWOOD REGIONAL AIRPORT (BWD)
12 Burnet Municipal Airport (BMQ)
13 Childress Municipal Airport (CDS)
14 College Station (CLL)
15 Conroe Montgomery County Airport (CXO)
16 Corpus Christi International Airport (CRP)
17 CORPUS CHRISTI: CORPUS CHRISTI NAS/TRUAX FIELD ARPT (NGP)
18 Corsicana Campbell Field (CRS)
19 Cotulla La Salle Co Airport (COT)
20 Dalhart Municipal Airport (DHT)
21 Dallas - Fort Worth International Airport (DFW)
22 Dallas Love Field (DAL)
23 Dallas Redbird Airport (RBD)
24 Del Rio International Airport (DRT)
25 Denton Municipal Airport (DTO)
26 Dryden Terrell County Airport (6R6)
27 El Paso International Airport (ELP)
28 FALFURRIAS : BROOKS COUNTY AIRPORT (BKS)
29 Fort Stockton Pecos County Airport (FST)
30 Fort Worth Alliance Airport (AFW)
31 Fort Worth Meacham (FTW)
32 FREDERICKSBURG: GILLESPIE COUNTY AIRPORT (T82)
33 GAINESVILLE : GAINESVILLE MUNICIPAL AIRPORT (GLE)
34 Galveston Scholes Field (GLS)
35 GEORGETOWN : GEORGETOWN MUNICIPAL AIRPORT (GTU)
36 Harlingen Rio Grande Valley I (HRL)
37 Hondo Municipal Airport (HDO)
38 Houston Bush Intercontinental (IAH)
39 Houston Clover Field (LVJ)
40 Houston Hooks Memorial Airport (DWH)
41 Houston Sugarland Mem (SGR)
42 Houston William P Hobby Airport (HOU)
43 Huntsville Municipal Airport (UTS)
44 JASPER : JASPER COUNTY-BELL FIELD AIRPORT (JAS)
45 Junction Kimble County Airport (JCT)
46 KERRVILLE : KERRVILLE MUNI/LOUIS SCHREINER FLD AIRPORT (ERV)
47 KILLEEN : KILLEEN MUNICIPAL AIRPORT (ILE)
48 KINGSVILLE : KINGSVILLE NAS AIRPORT (NQI)
49 LA GRANGE : FAYETTE REGIONAL AIR CENTER AIRPORT (3T5)
50 Longview E Tx Rgnl Airport (GGG)
51 Lubbock International Airport (LBB)
52 Lufkin Angelina Cty Airport (LFK)
53 MARFA : MARFA MUNICIPAL AIRPORT (MRF)
54 McAllen Miller International Airport (MFE)
55 McKinney Municipal Airport (TKI)
56 Midland International Airport (MAF)
57 Mineral Wells Airport (MWL)
58 MOUNT PLEASANT : MOUNT PLEASANT REGIONAL AIRPORT (OSA)
59 NACOGDOCHES : A L MANGHAM JR REGIONAL AIRPORT (OCH)
60 New Braunfels Municipal Airport (BAZ)
61 Odessa Schlemeyer Field (ODO)
62 Palacios Municipal Airport (PSX)
63 PARIS : COX FIELD AIRPORT (PRX)
64 PERRYTON : PERRYTON OCHILTREE COUNTY AIRPORT (PYX)
65 Pine Springs Guadalupe Mounta (GDP)
66 Port Arthur Se Tx Rgnl Airport (BPT)
67 Port Isabel Cameron County Airport (PIL)
68 Rockport Aransas Co Airport (RKP)
69 San Angelo Mathis Field (SJT)
70 San Antonio International Airport (SAT)
71 San Antonio Stinson Municipal Airport (SSF)
72 SAN MARCOS : SAN MARCOS MUNICIPAL AIRPORT (HYI)
73 SWEETWATER : AVENGER FIELD AIRPORT (SWW)
74 TEMPLE: DRAUGHON-MILLER CNTRL TEXAS REGIONAL ARPT (TPL)
75 Terrell Municipal Airport (TRL)
76 Tyler Pounds Field (TYR)
77 Victoria Regional Airport (VCT)
78 WACO : MC GREGOR EXECUTIVE AIRPORT (PWG)
79 Waco Regional Airport (ACT)
80 WESLACO : MID VALLEY AIRPORT (T65)
81 Wichita Falls Municipal Airport (SPS)
82 Wink Winkler Co Airport (INK)

Texas TMY2 Weather Files

1 Abilene
2 Amarillo
3 Austin
4 Brownsville
5 Corpus Christi
6 El Paso
7 Fort Worth
8 Houston
9 Lubbock
10 Lufkin
11 Midland
12 Port Arthur
13 San Angelo
14 San Antonio
15 Victoria
16 Waco
17 Wichita Falls

Texas WYEC2 Weather Files

1 El Paso
2 Brownsville
3 Fort Worth
4 San Antonio

NREL Solar Stations

1 Abilene
2 Austin
3 Big Spring
4 Canyon
5 Clear Lake
6 Corpus Christi
7 Del Rio
8 Edinburg
9 El Paso
10 Laredo
11 Menard
12 Overton
13 Pecos
14 Presidio
15 Sanderson

TCEQ Solar Stations

1 Bexar
2 Travis
3 El Paso (2)
4 Galveston
5 Harris (5)

FCHART and PV FCHART (New Weather File)

1 ABILENE
2 AMARILLO
3 AUSTIN
4 BROWNSVILLE
5 CORPUS CHRISTI
6 EL PASO
7 FORT WORTH
8 HOUSTON
9 LUBBOCK
10 LUFKIN
11 MIDLAND-ODESSA
12 PORT ARTHUR
13 SAN ANGELO
14 SAN ANTONIO
15 SHERMAN
16 VICTORIA
17 WACO
18 WICHITA FALLS

Figure 179 : List of Available Weather Files in Texas (Listed by Symbol)

9 Regional Energy Baselines and Measurement and Verification Protocols

9.1 Summary

This report is the continuation of the previous 2009 regional energy baseline report using the U.S. DOE EIA's 1960-2006 energy data performed for the Southern Energy Efficiency Center (SEEC), which was defined under the SEEC Subtask 3.1 *Define Regional Baselines and Measurement & Verification Protocols.* The primary goal of this subtask is to provide the state energy offices with a comparison tool for energy use either by total or per-capita usage. This tool is expected to allow the state energy offices to compare their energy use pattern against other states' and the national average energy use by end-use sector. In addition, they can use this tool for a comparison of energy use within their states by end-use and by fuel-source.

To define new baseline energy patterns for Texas using the U.S. DOE EIA's 1960-2009 energy data, the raw data have been downloaded from both the U.S. DOE EIA website[65], and the U.S. Census Bureau website[66]. Appendices A and B present the detailed information of data sets that have been used for this analysis, including the source, selected data codes, and term definitions.

The deliverables in this report consist of three parts:

- Energy use per capita ranked by state for 2009 (latest year data available);
- Historical energy use per capita for the 12 SEEC states during 1960-2009; and
- Energy use and energy use per capita by end-use sector and fuel source during 1960-2009 for the U.S. and Texas.

Section 2 presents the charts showing the energy use per capita ranked by state for 2009, including total use and use by end-use sector. Section 3 presents the charts showing the historical energy use per capita for the Texas during 1960-2009, including total use and use by end-use sector. Section 4 presents the charts showing the energy use and energy use per capita by end-use sector and fuel source during 1960-2009 for the U.S. and Texas.

9.2 Overview

This section covers the energy use per capita of the 50 states and the District of Columbia for the year of 2009, including total energy use per capita (Figure 143) and energy use per capita by end-use sector (Figure 9.4 through Figure 9.7): electric power, residential, commercial, residential plus commercial, transportation, and industrial sector. Two different scales were selected and used to display data for comparison purposes: 1,200 MMBtu for the charts of total and electric power sector and 600 MMBtu for the charts of other sectors, including residential, commercial, residential plus commercial, transportation, and industrial sector.

Each state's energy use per capita is ranked by state with the U.S. average energy use per capita. The green bar indicates the U.S. average energy use per capita and is displayed with a dotted green line for a better comparison. The red bar indicates Texas energy use per capita, while the 50 blue bars are for the other 49 states and the District of Columbia.

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[65] U.S. DOE, EIA. 2011. *Consumption, Price, and Expenditure Estimates through 2009: Complete Data Files, All States and All Years*, State Energy Data System (SEDS), Energy Information Administration, U.S. Department of Energy, Retrieved from http://www.eia.doe.gov/emeu/states/_seds.html (accessed February 2, 2009).

[66] U.S. Census Bureau. 2009. *Annual Population Estimates 2000 to 2009: Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2009*, National and State Population Estimates, U.S. Census Bureau, Retrieved from http://www.census.gov/popest/states/NST-ann-est.html (accessed June 30, 2011).

9.3 Total Energy Use per Capita, Ranked by State (2009)

Figure 180 shows the total energy use per capita of the 50 states and the District of Columbia for the year of 2009. The U.S. average was 308 MMBtu per capita, and Texas ranked in sixth place at 456 MMBtu. Texas's high ranking is mainly due to its high industrial energy consumption, which represents about 49% of total energy use per capita.

Wyoming, Alaska, Louisiana, and North Dakota have a distinctly high energy use pattern: about three to five times more energy per capita than the low energy-intensive states. This could be due to their high transportation and industrial energy consumption and low population density of Wyoming, Alaska, and North Dakota. On the contrary, New York State's low energy intensity can be explained with its high population density.

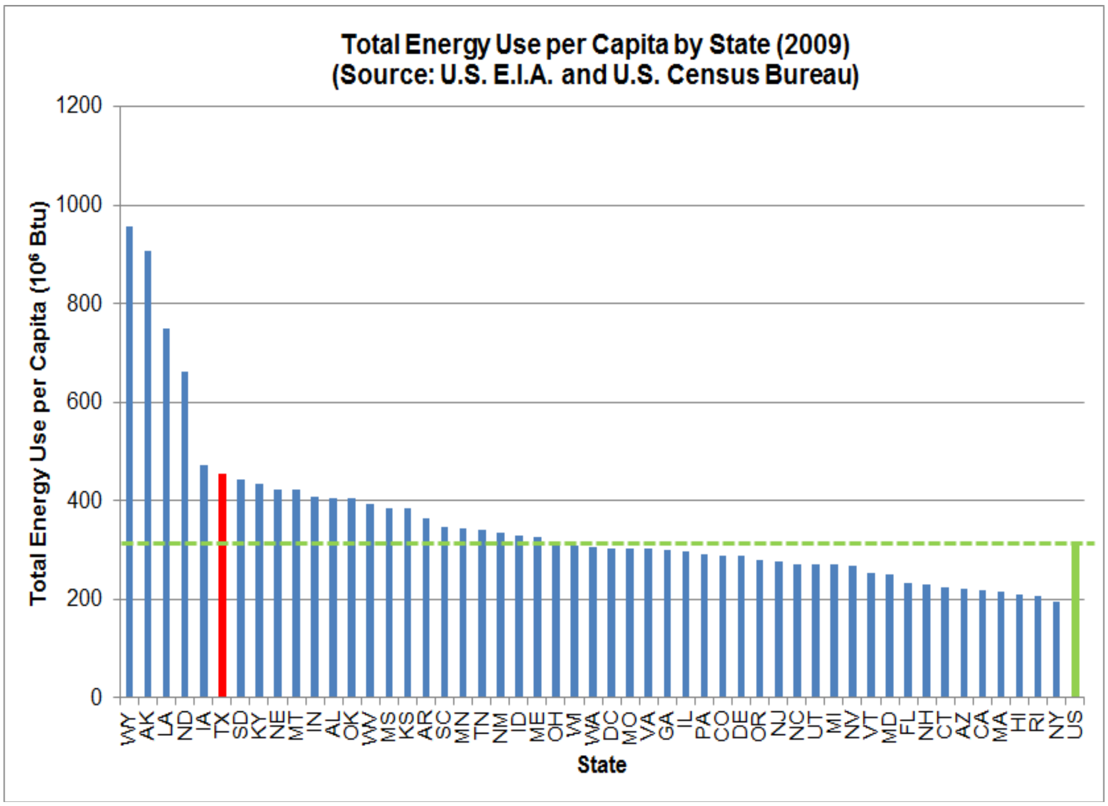

Figure 180. Total Energy Use per Capita, Ranked by State, 2009.

9.4 Electric Power Energy Use per Capita, Ranked by State (2009)

Figure 9.4 shows the electric power energy use per capita of the 50 states and the District of Columbia for the year 2009. The electric power energy use consists of the energy consumed by facilities to generate, transmit, and distribute electric energy. The U.S. average was 124 MMBtu per capita, and Texas had a higher electric power energy use per capita than the U.S. average: 144 MMBtu per capita.

Wyoming had the highest electric power energy use per capita for 2009 with 874 MMBtu per capita, whereas the District of Columbia had the lowest value with 0.8 MMBtu per capita. Wyoming's high electric power energy intensity, in spite of its very low population density in the U.S., could be due to the massive power facilities in Wyoming that provide electricity to the western United States. On the contrary, the District of Columbia showed abnormally low electric power energy intensity because D.C. relies on imported electricity from the surrounding states. It must be noted that the amount of electricity produced in the state is sometimes different from the amount consumed in the state. North Dakota and West Virginia, as interstate exporters of electricity, also showed distinctly high electric power energy intensity: about three to four times more energy per capita than the U.S. average.

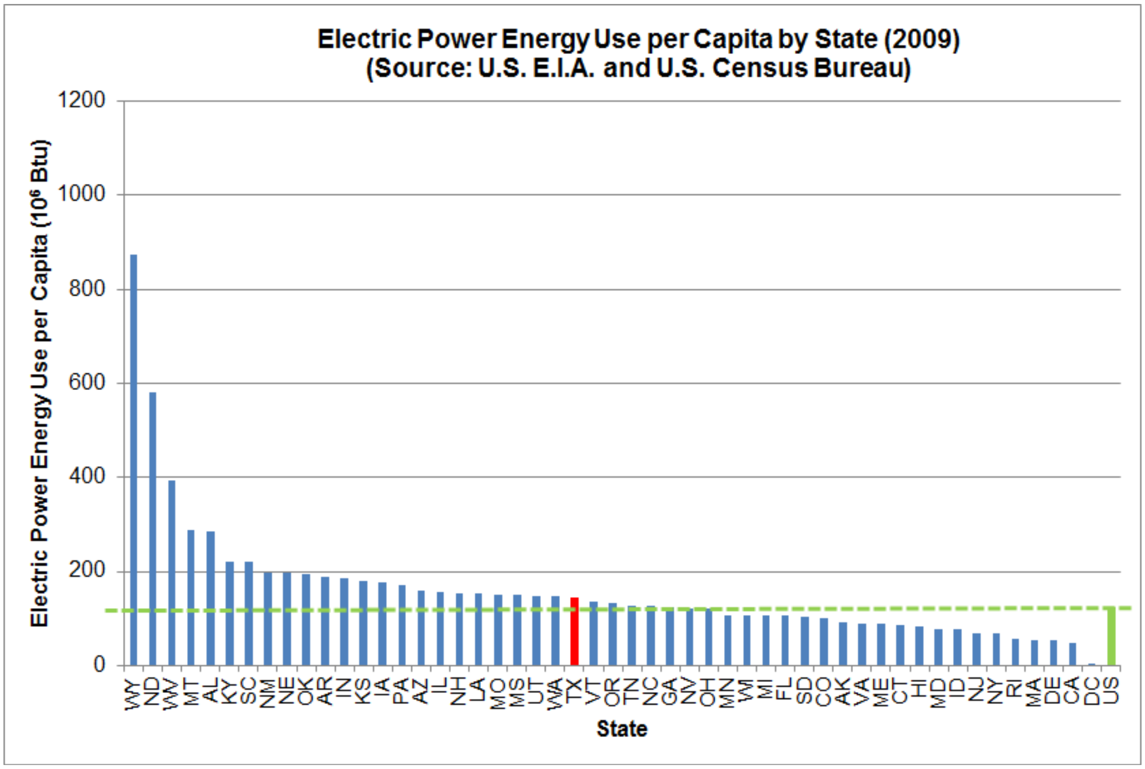

Figure 181. Energy Use per Capita by the Electric Power Sector, Ranked by State, 2009

9.5 Residential and Commercial Energy Use per Capita, Ranked by State (2009)

Figure 183, respectively, show the residential and the commercial energy use per capita of the 50 states and the District of Columbia for the year 2009. Figure 9.5 shows the combined residential and commercial per capita energy use that can be regarded as the entire building sector's per capita energy use. The commercial energy use consists of the energy consumed by many different building types, including businesses, institutions, and organizations that provide services. For the purpose of a comparison and clarity, a different scale was used in Sections 2.4 to 2.6.

The U.S. average was 69 MMBtu per capita for the residential sector and 58 MMBtu per capita for the commercial sector. For both residential and commercial building sectors, the variation between states was relatively small compared with other end-use sectors. Texas had a lower residential energy use per capita than the U.S. average: 65 MMBtu per capita, while its commercial energy use per capita was slightly higher than the U.S. average: 59 MMBtu per capita.

The variation of residential energy intensity between the states was relatively small except for the two least energy-intensive states of California and Hawaii. For the commercial buildings sector, the variation between states was relatively small except for the four top-ranking states, D.C., Wyoming, North Dakota, and Alaska, and the two low-ranking states of California and Hawaii. A similar pattern was found in the combined residential and commercial per capita energy use. It is noticeable that California had far less combined residential and commercial per capita use than the other states and the US average. This could be partly because of their mild climate, and partly because of their earliest adoption of various energy policies and incentives..

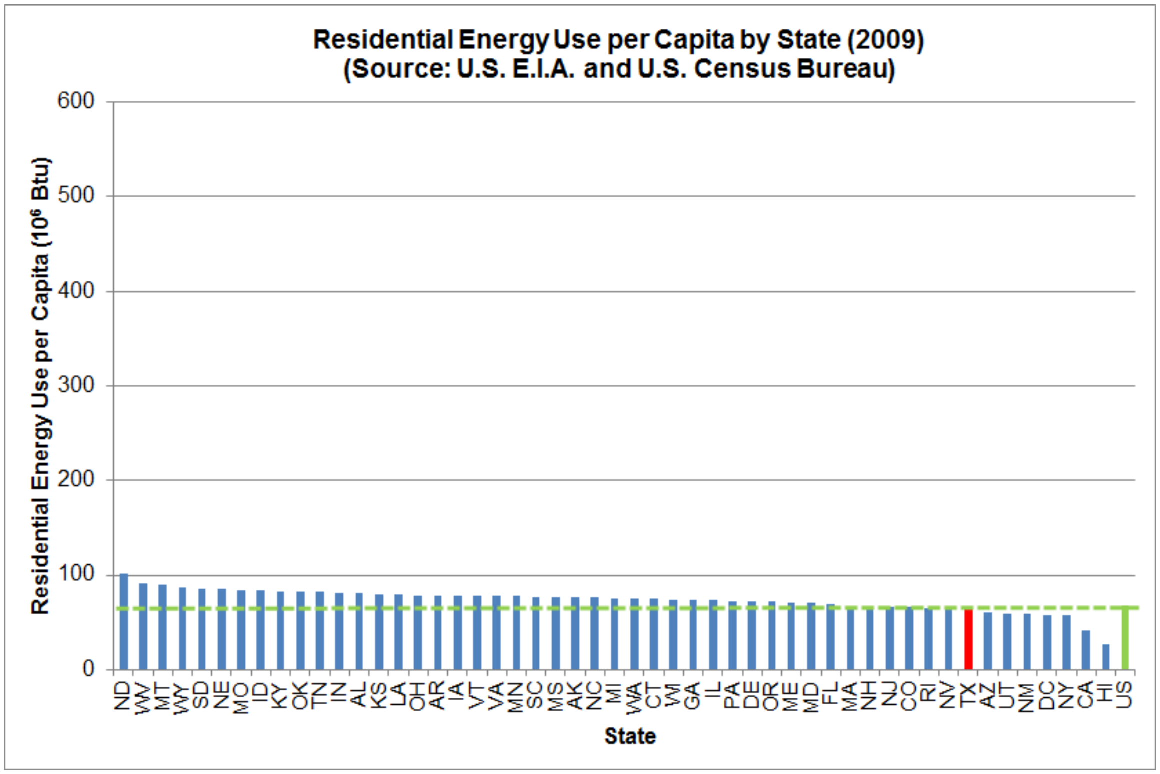

Figure 182. Energy Use per Capita by the Residential Sector, Ranked by State, 2009.

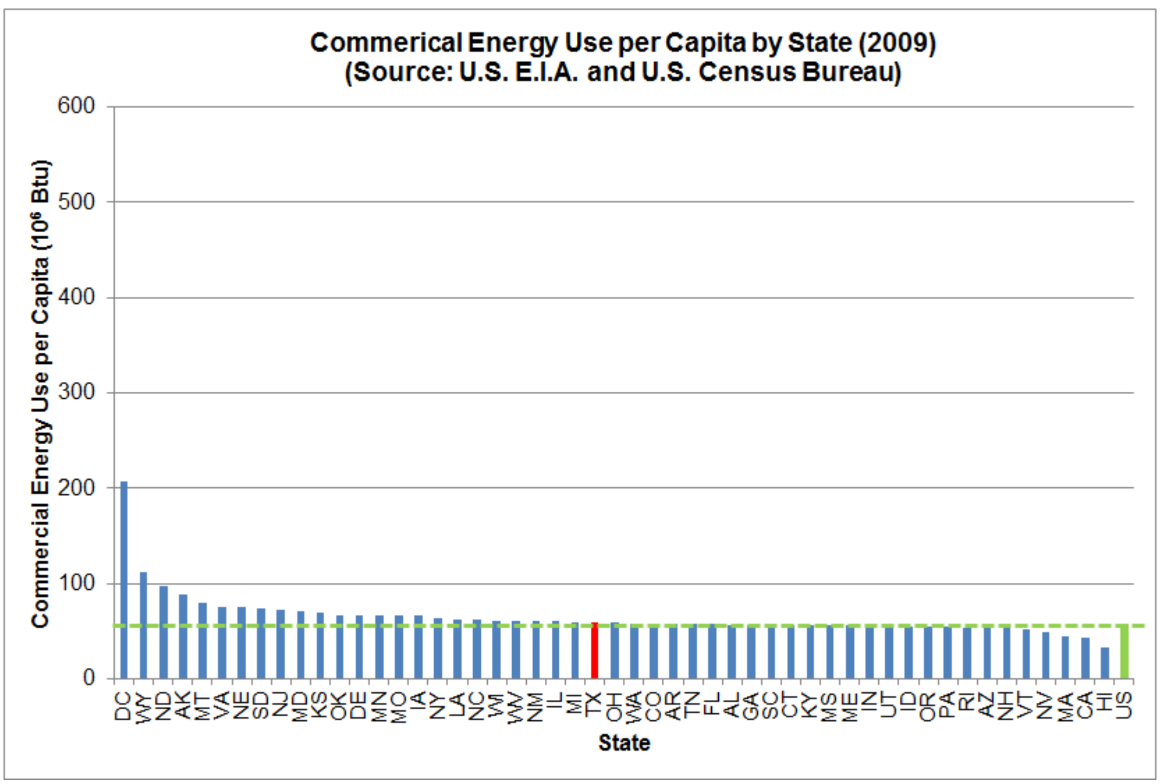

Figure 183: Energy Use per Capita by the Commercial Sector, Ranked by State, 2009.

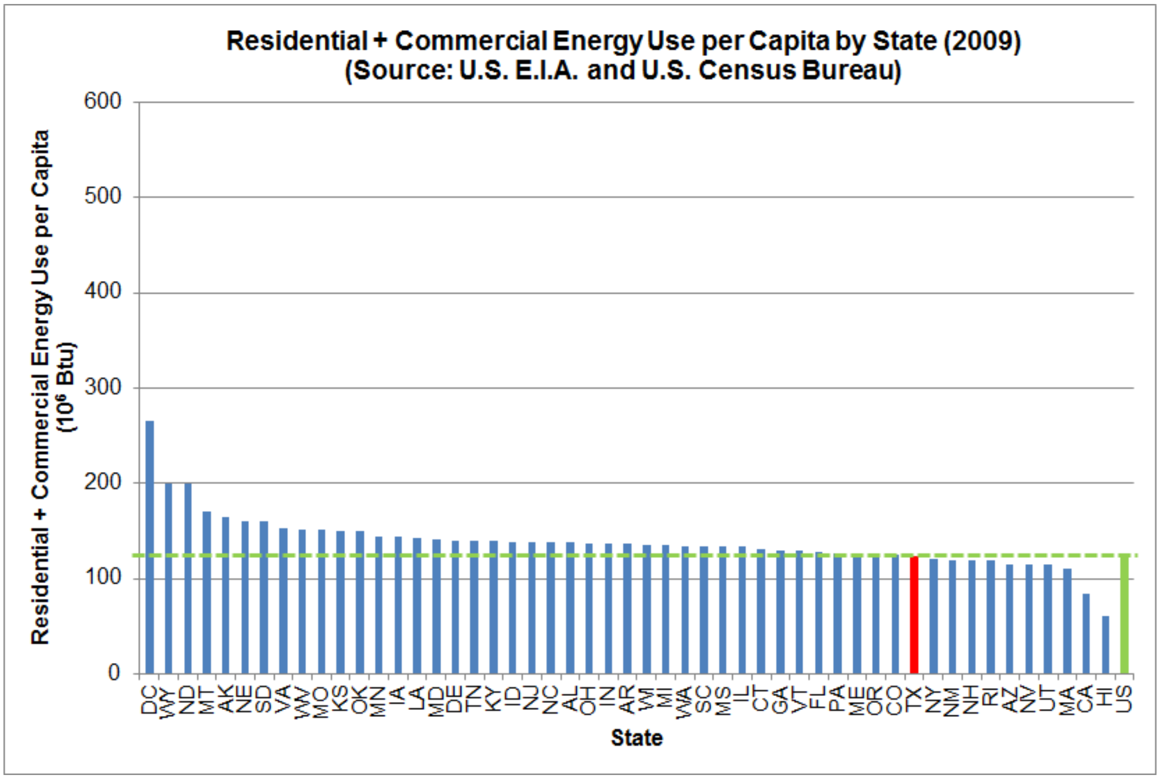

Figure 184 Energy Use per Capita by the Residential and Commercial Sector, Ranked by State, 2009.

9.6 Transportation Energy Use per Capita, Ranked by State (2006)

Figure 185 shows the transportation energy use per capita of the 50 states and the District of Columbia for the year 2009. The U.S. average was 88 MMBtu per capita. Texas had higher transportation energy use per capita than the U.S. average: 110 MMBtu per capita.

Alaska had the highest transportation energy use per capita for 2009 with 274 MMBtu, whereas the District of Columbia had the lowest value with 32 MMBtu. Alaska's high transportation energy intensity may be partly because of its high aviation fuel consumption, and its high industrial energy consumption. Similarly, the District of Columbia's very low transportation energy intensity can be explained with its high availability and usage of public transportation. A similar result can be found in New York which ranked in the second lowest place due to its public transportation.

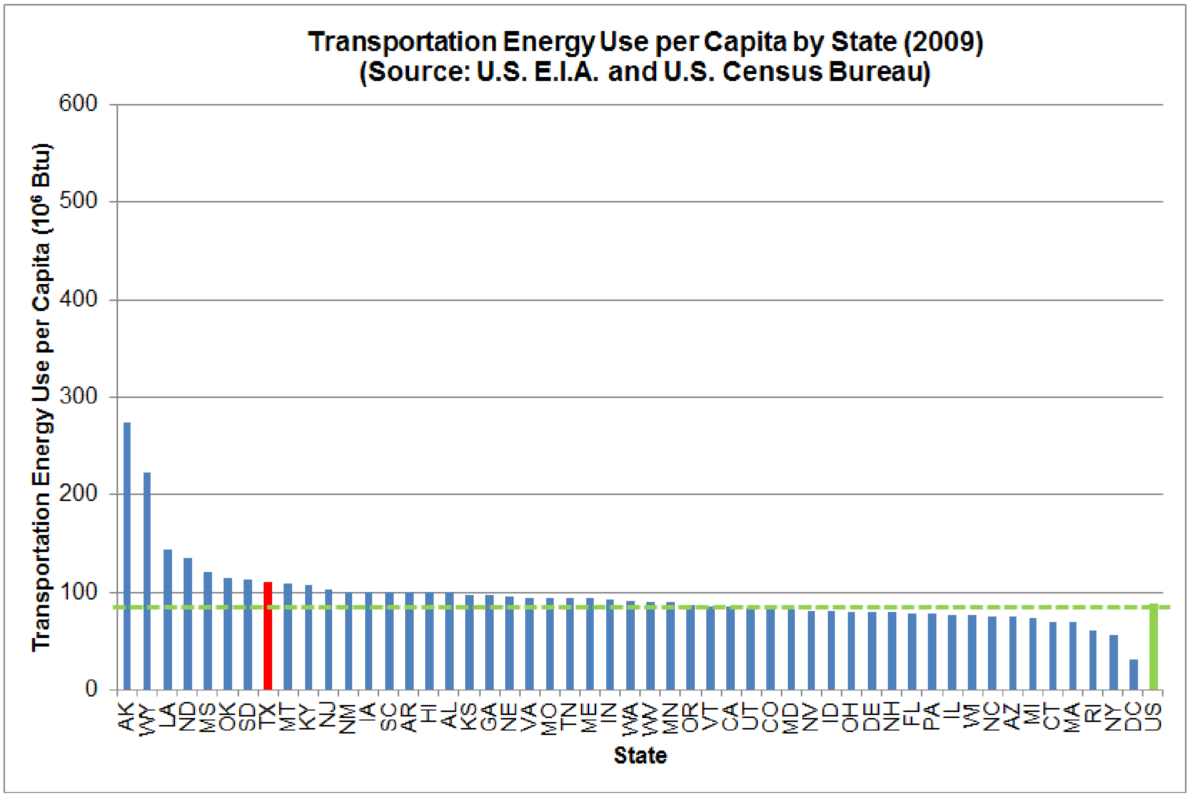

Figure 185: Energy Use per Capita by the Transportation Sector, Ranked by State, 2009

9.7 Industrial Energy Use per Capita, Ranked by State (2006)

Figure 186 shows the industrial energy use per capita of the 50 states and the District of Columbia for the year 2009. The U.S. average was 93 MMBtu per capita, and Texas ranked in sixth place at 222 MMBt, which is much higher than the U.S. average.

The variation of industrial energy intensity between states was very high compared with other end-use sectors. Wyoming had the highest industrial energy use per capita for 2009 with 533 MMBtu, whereas the District of Columbia had the lowest value with 6.5 MMBtu. Alaska, Louisiana, North Dakota, Iowa, and Texas also showed distinctly high industrial energy intensity, more than twice the U.S. average. Due to the large amount of energy consumption by the industrial sector, industrial energy intensity can be regarded as the most significant determinant of total energy use pattern of each state. The ranking of total energy use per capita generally matched closely with the ranking of industrial energy use per capita.

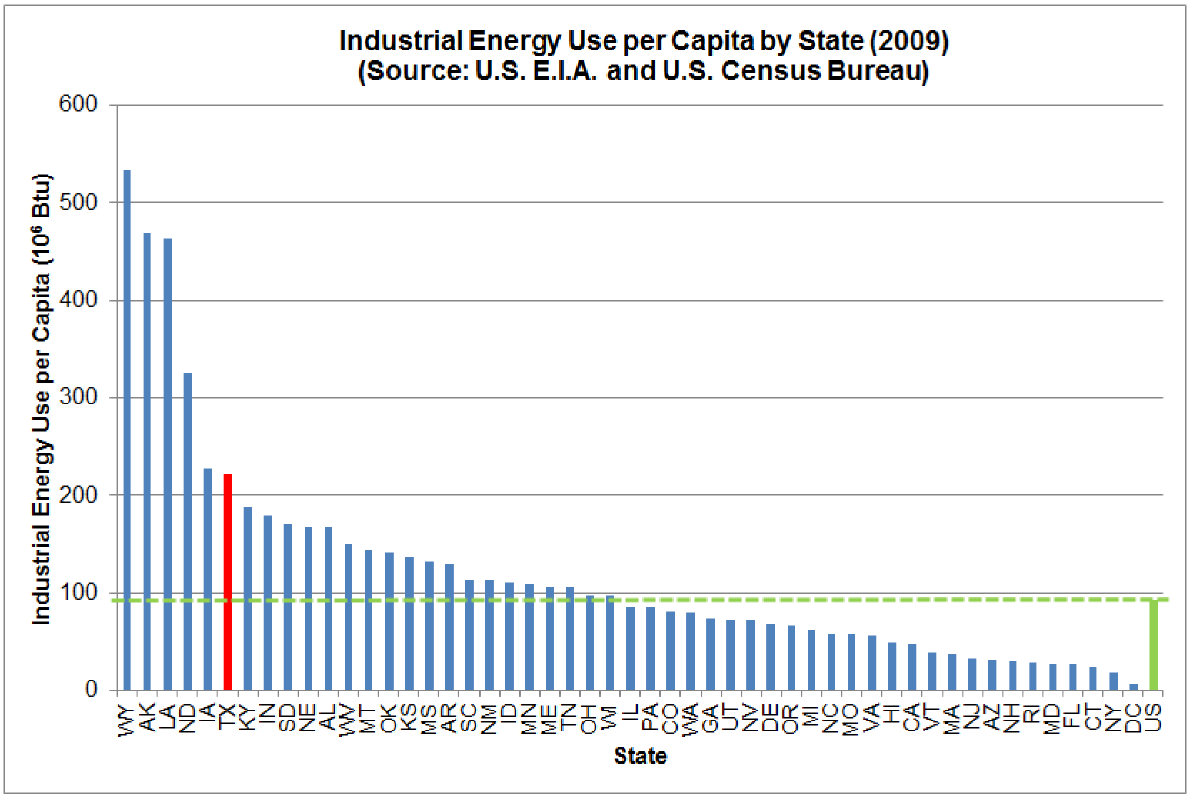

Figure 186: Energy Use per Capita by the Industrial Sector, Ranked by State, 2009.

9.8 Historical Energy Use per Capita for the 12 Southern States during 1960-2009

9.8.1 Overview

This section covers the historical energy use per capita of the 12 SEEC states during the period of 1960 to 2009, including total energy use per capita (Figure 187) and energy use per capita by end-use sector (Figure 188 through Figure 192): electric power, residential, commercial, residential plus commercial, transportation, and industrial sector. Two different scales were selected and used to display data for the comparison purposes. The following scales were used: 1,200 MMBtu for the charts of total and industrial sector and 350 MMBtu for the charts of other sectors, including residential, commercial, residential plus commercial, transportation, and electric power sector.

Each state's energy use per capita is displayed with the U.S. average energy use per capita; the red line indicates the U.S. average energy use per capita. The other 12 lines indicate the historical energy use pattern of each 12 SEEC states - Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia..

9.8.2 Total Energy Use per Capita for the Southern 12-States during 1960-2009

Figure 187 shows the total energy use per capita of the 12 SEEC states during the period of 1960 to 2009. Louisiana ranked the highest, and the second highest was Texas. This is mainly due to their high industrial energy use per capita. It is noticeable that Texas's total energy use per capita has decreased since 2000. Florida ranked the lowest; and since the middle of the 1970's, their energy use pattern remained almost flat - around 250 MMBtu per capita, less than the U.S. average. Except for the above-mentioned three states, the per capita energy use patterns of the other nine states were tightly grouped.

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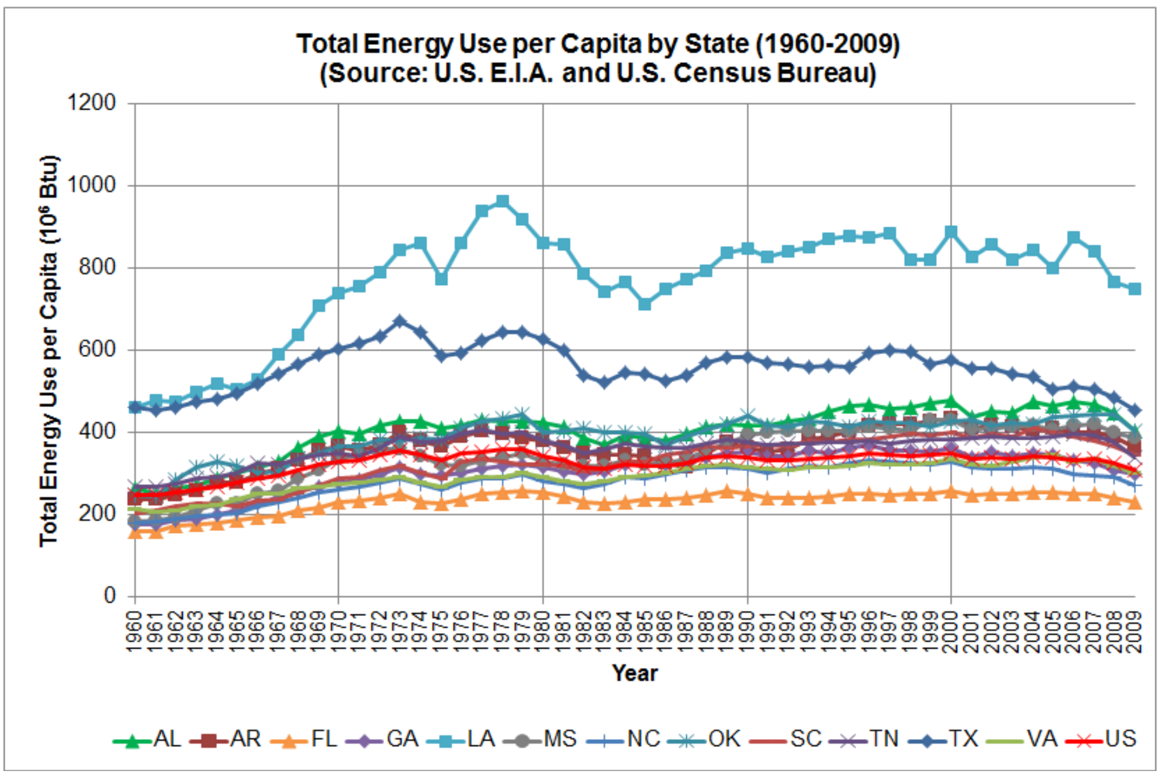


Figure 187:Total Energy Use per Capita, for the 12 SEEC States during 1960-2009.

9.8.3 Industrial Energy Use per Capita for the 12 Southern States during 1960-2009

Figure 188 shows the industrial energy use per capita of the SEEC states during the period of 1960 to 2009. The historical per capita industrial energy use pattern has parallels with the total energy use per capita addressed in the previous section. Louisiana ranked the highest, and the second highest was Texas. It is noticeable that that Texas's industrial energy use per capita has been decreasing since 2000. Florida ranked the lowest, which is much less than the U.S. average. Except for the above-mentioned three states, the per capita industrial energy use patterns of the other nine states were tightly grouped.

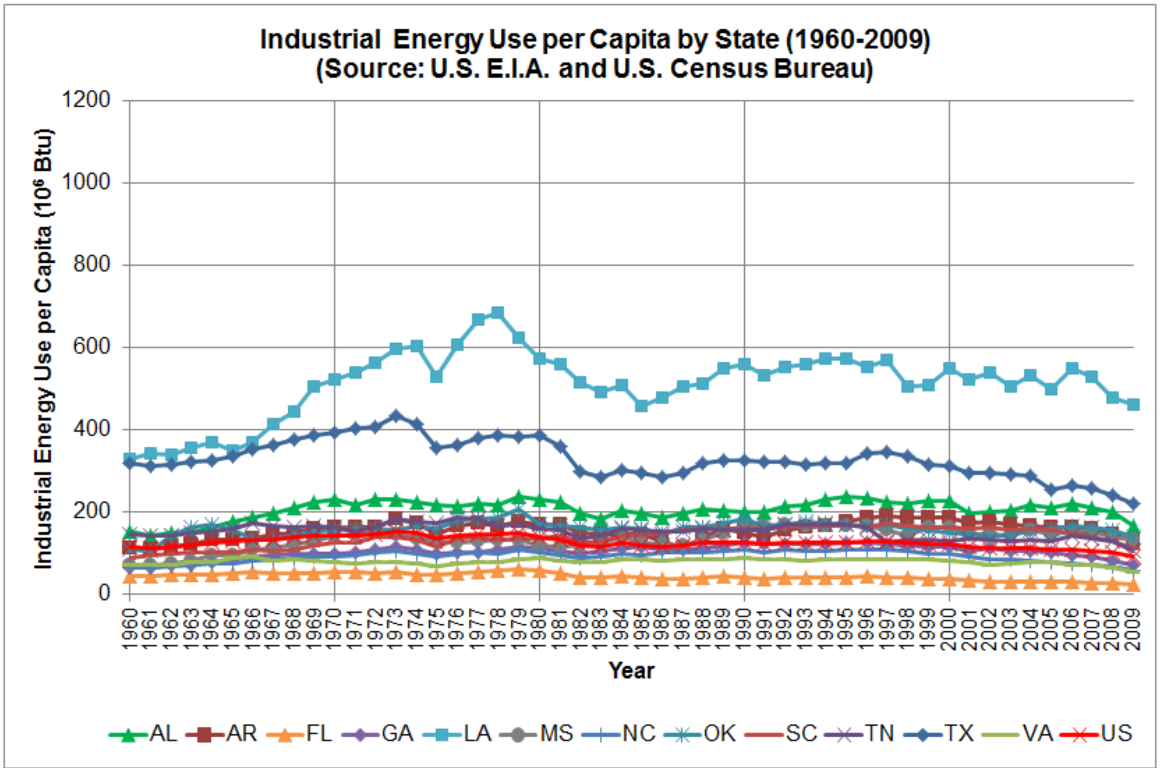


Figure 188. Energy Use per Capita by the Industrial Sector, for the 12 SEEC States during 1960-2009.

9.8.1 Residential and Commercial Energy Use per Capita for the 12 Southern States during 1960-2009

Figure 189 and Figure 190, respectively, shows the residential and the commercial energy use per capita of the 12 SEEC states during the period of 1960 to 2009, while Figure 192 shows the combined residential and commercial per capita energy use that can be regarded as the whole building sector's per capita energy use. The commercial energy use consists of the energy consumed by many different building types, including businesses, institutions, and organizations that provide services. For the purpose of a comparison, a different scale was used in Sections 9.8.1 to 9.8.3.

For both residential and commercial, the per capita energy use has been slightly increasing over the years. However, the variation across states was very small compared with other end-use sectors; per capita energy uses of all twelve states were tightly grouped with a range of about 20 MMBtu per capita. In 2009, Oklahoma ranked the highest, and the lowest was Texas. For the commercial sector, Virginia ranked the highest, and Mississippi the lowest. Virginia ranked the highest of the combined residential and commercial per capita energy use in 2009. Texas was the lowest among the 12 SEEC states. It is noticeable that Texas' residential energy use per capita has been decreasing since 2000. In addition, abnormal commercial energy use patterns were found in Louisiana and Tennessee. In the late 1970's, Louisiana's commercial energy use per capita was increasing while in the middle 1990's, Tennessee's commercial energy use per capita declined suddenly.

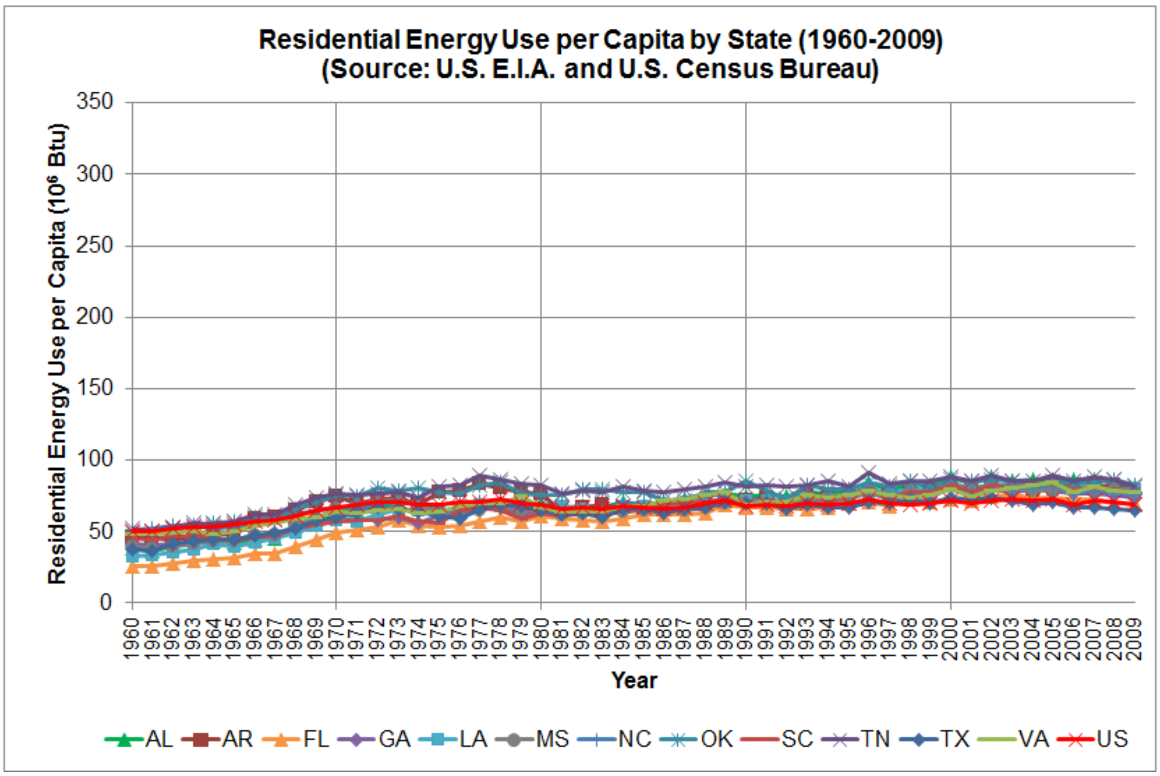


Figure 189. Energy Use per Capita by the Residential Sector, for the 12 SEEC States during 1960-2009.

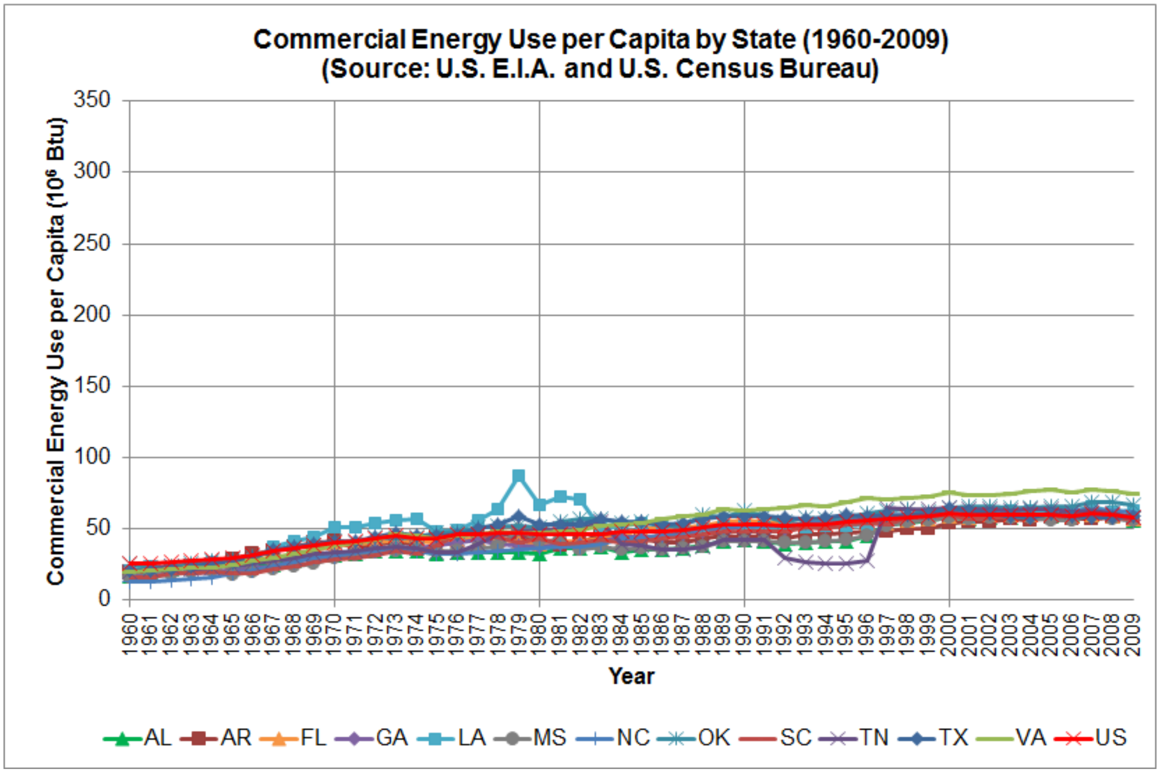


Figure 190. Energy Use per Capita by the Commercial Sector, for the 12 SEEC States during 1960-2009.

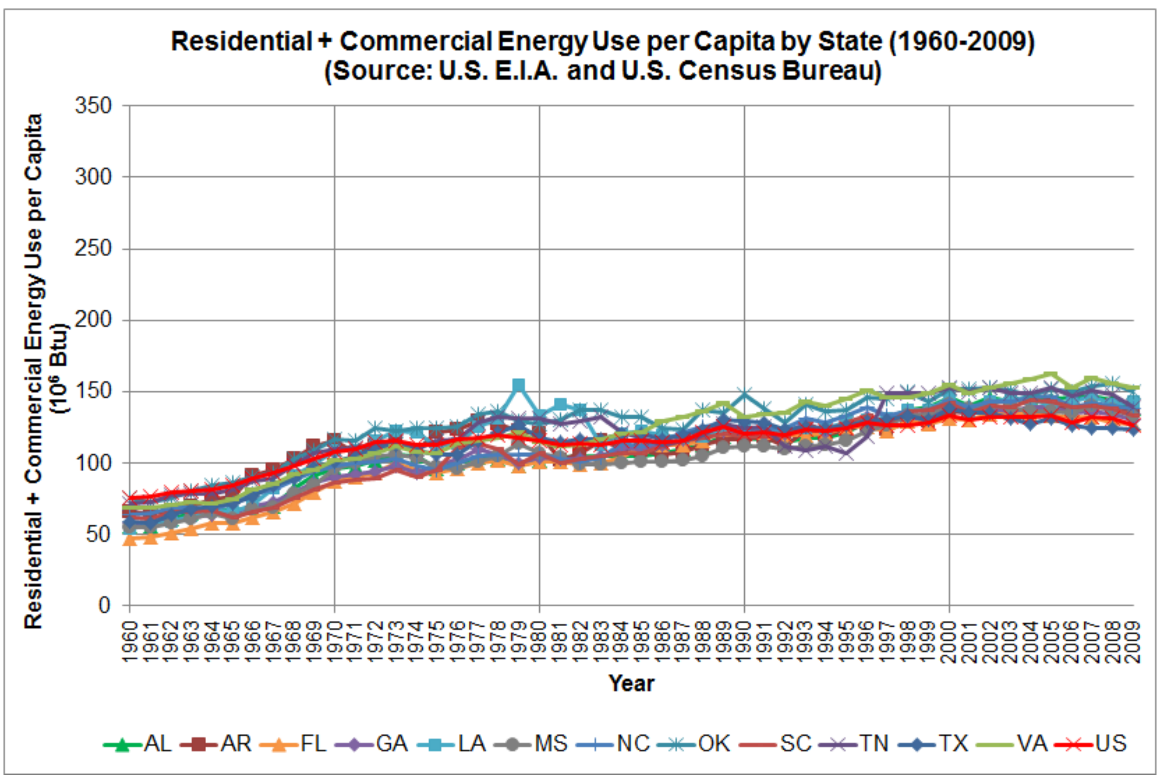


Figure 191. Energy Use per Capita by the Residential and Commercial Sector, for the 12 SEEC States during 1960-2009.

9.8.2 Transportation Energy Use per Capita for the 12 Southern States during 1960-2009

Figure 192 shows the transportation energy use per capita of the 12 SEEC states during the period of 1960 to 2009. The historical per capita transportation energy use patterns have remained constant since the middle 1970's (except for Louisiana) and have started decreasing since 2007. Louisiana ranked the highest and showed distinctly high transportation energy intensity. This is mainly because of the river bridge traffic to transport oil and gas. The second highest group consists of Mississippi, Oklahoma, and Texas. It is notable that Texas' transportation energy intensity is constant since 1980. The lowest group was Florida and North Carolina.

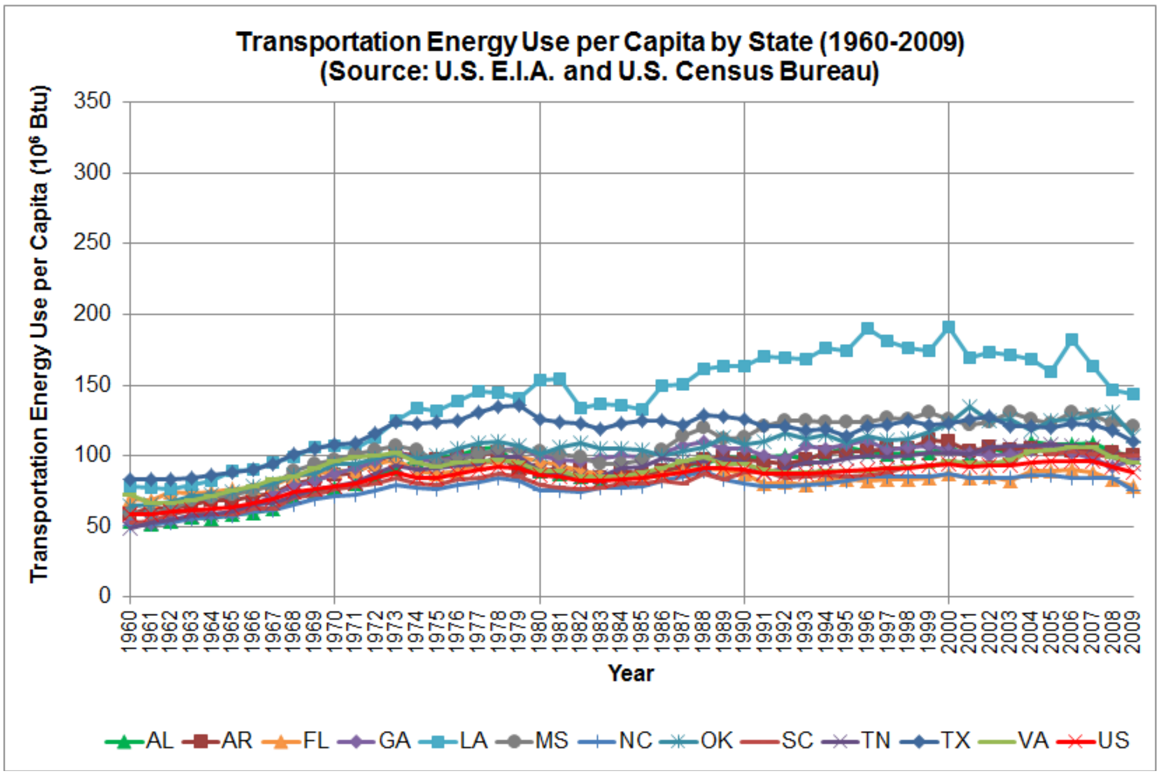


Figure 192. Energy Use per Capita by the Transportation Sector, for the 12 SEEC States during 1960-2009.

9.8.3 Electric Power Energy Use per Capita for the 12 Southern States during 1960-2009

Figure 193 shows the electric power energy use per capita of the 12 SEEC states during the period of 1960 to 2009. The electric power energy use consists of the energy consumed by facilities to generate, transmit, and distribute electric energy. Thus, it must be noted that the amount of electricity produced in the state is different from that consumed in the state.

The historical per capita electric power energy use per capita has been rising constantly across all twelve states. Alabama showed a distinctly high consumption and ranked the highest at 286 MMBtu per capita in 2009. The second highest was South Carolina at 221 MMBtu per capita in 2009, and the lowest group consists of Florida and Virginia. Although the top two states, Alabama and South Carolina, export surplus energy to other states, they are also big electricity energy consumers. Among the 50 states and the District of Columbia, Alabama and South Carolina ranked in fifth and seventh place, respectively, in total electricity energy per capita consumed within the state in 2009.

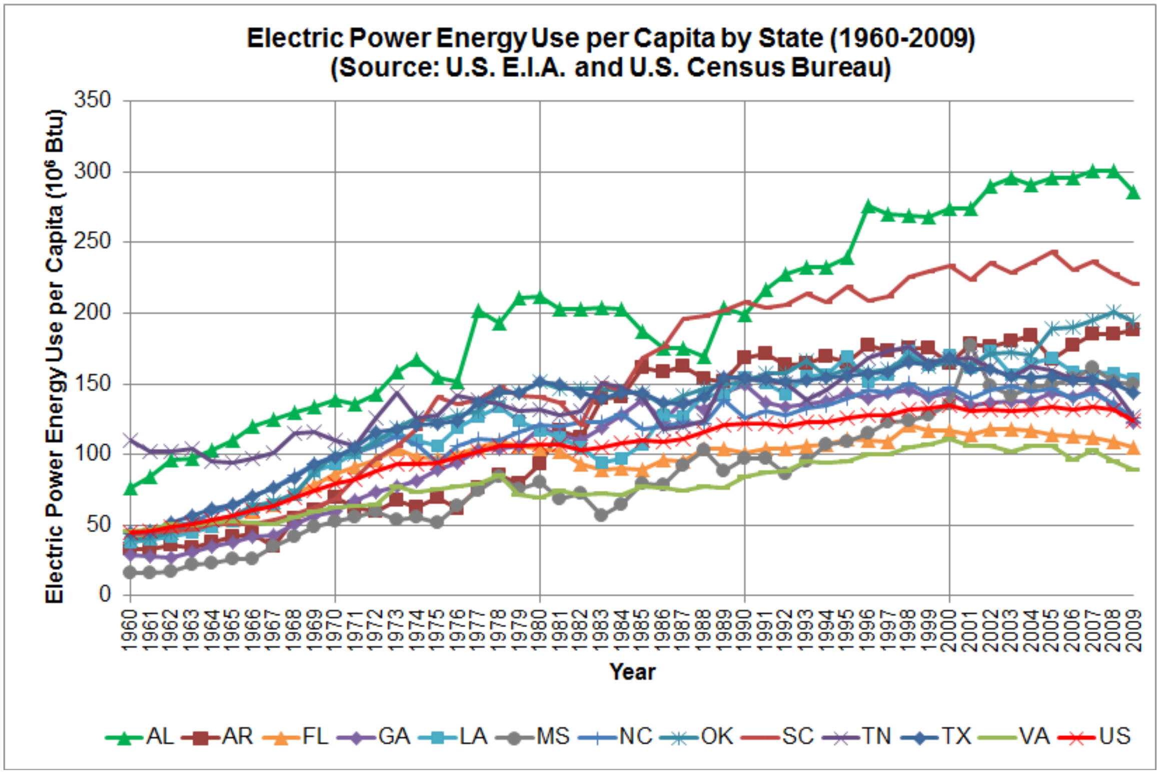


Figure 193: Energy Use per Capita by the Electric Power Sector, for the 12 SEEC States during 1960-2009

9.9 Energy Use and Energy Use per Capita by End-Use Sector and Fuel Source During 1960-2006 for U.S. and Texas

9.9.1 Overview

This section covers the historical energy use and energy use per capita by end-use sector and fuel source during 1960-2009 for the U.S. and Texas. This section can be used for a comparison of energy use within the states by end-use and by fuel-source. The end-use sectors consist of residential, commercial, industrial and transportation. The fuel sources consist of coal, natural gas, petroleum and other. Other fuel source includes nuclear electric power, hydro-electric power, biomass, geothermal, wind, photovoltaic, solar thermal energy, and net imports of electricity.

In Section 9.9.2, the historical U.S. total energy use, both total and per capita, is displayed by end-use sector and by fuel source. In Sections 9.9.3, historical Texas energy use, both total and per capita, is displayed by end-use sector and by fuel source. The energy consumption of electric power sector was also displayed in the chart of end-use sector energy use. The red dotted line indicates the U.S. average energy use per capita

Table 71 presents the scales that were used for the charts in Sections 9.9.2-9.9.3. One hundred twenty and 14 quadrillion Btu were used to display data in the charts of total energy use for the U.S. and Texas, respectively. In the charts of per capita energy use, the scale, 500 MMBtu was used for the U.S., and for Texas, 1,000 MMBtu, was used.

Table 72: Chart Scales in Sections 9.9.2 to 9.9.3.

Section Number	State	Total (Quads=10^{15} Btu)	per Capita (10^{6} Btu)
4.2	US Total	120	500
4.3	Texas(TX)	14	1,000

9.9.2 U.S. Total

Figure 194 and Figure 195, respectively, show the total and per capita energy use of the U.S. by end-use sector (residential, commercial, industrial and transportation) and electric power sector during the period of 1960 to 2009. Figure 197and Figure 198, respectively, show the total and per capita energy use of the U.S. by fuel source during the period of 1960 to 2009. The U.S. total energy use has been continuously rising while per capita U.S. energy use has remained constant. Since 2007, both total and per capita energy use have started decreasing. Since 2000, the electric power sector consumed the largest amount of total energy among end-use sectors, followed by industrial, transportation, residential and commercial. By fuel source, the energy consumption of petroleum-based products distinctly occupied the largest proportion of the total. There were little differences between natural gas and coal products, and other fuel sources occupied the smallest proportion.

The total population and energy use information for the U.S. in 2009 are as follows:

- U.S. Total Population (2009): 306,656,290
- U.S. Total Energy Use (Quads=10^{15} Btu, 2009): 94.45 Quads

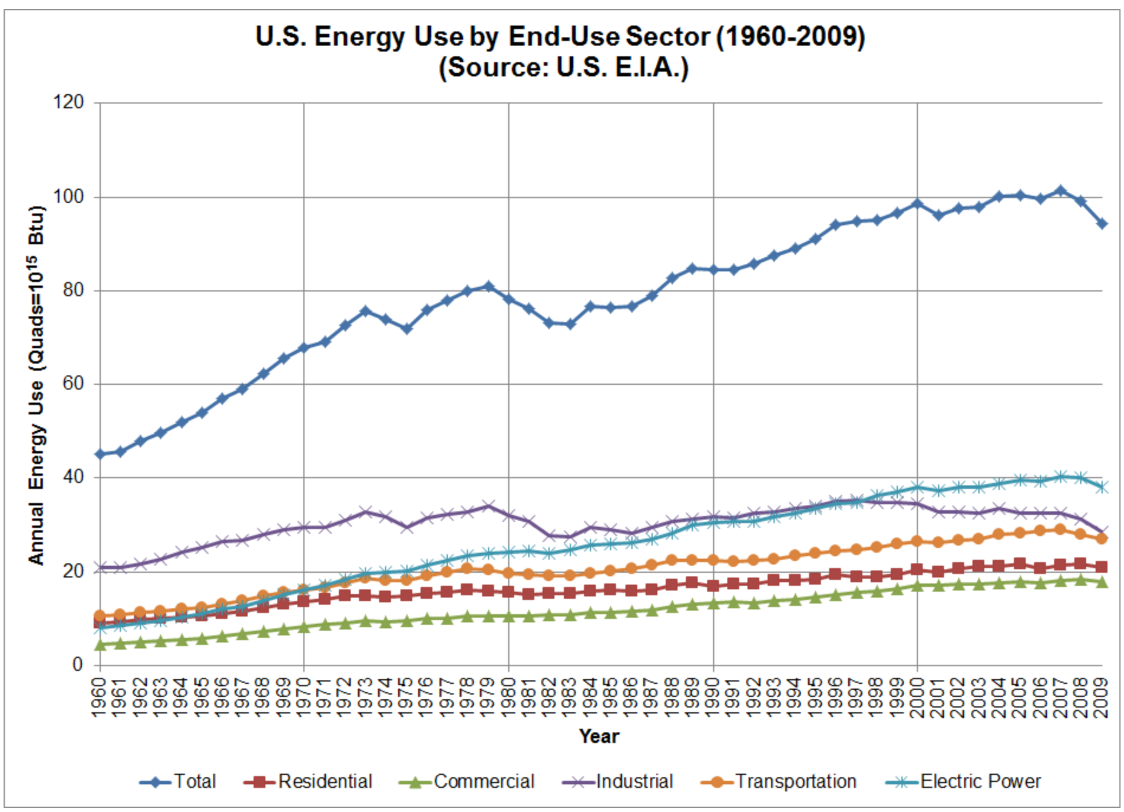


Figure 194: U.S. Total Energy Use by End-Use Sector during 1960-2009.

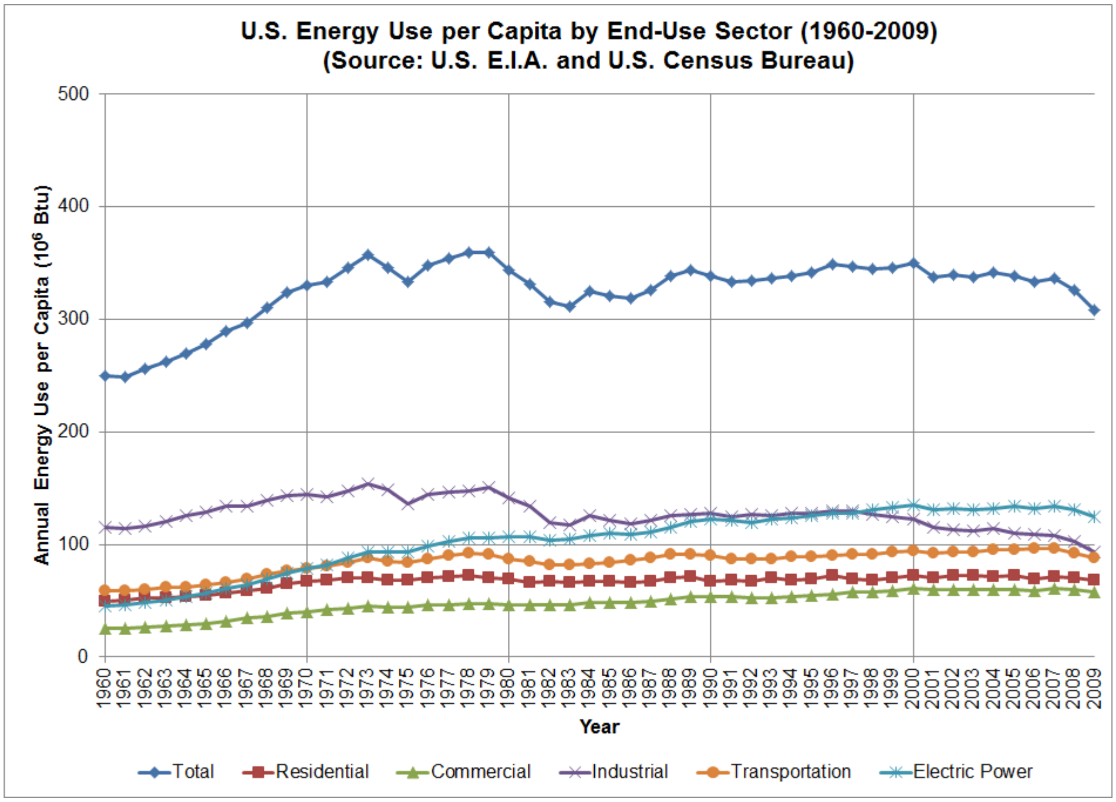


Figure 195: U.S. Total Energy Use per Capita by End-Use Sector during 1960-2009.

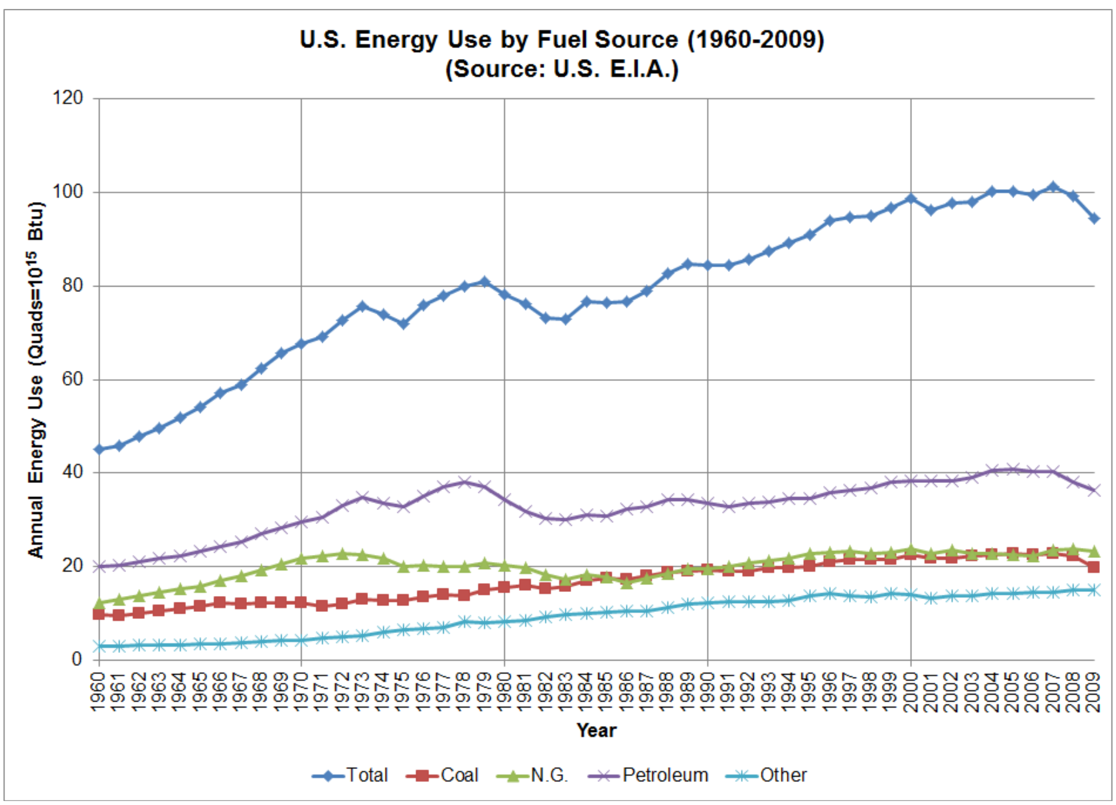


Figure 196: U.S. Total Energy Use by Fuel Source during 1960-2009.

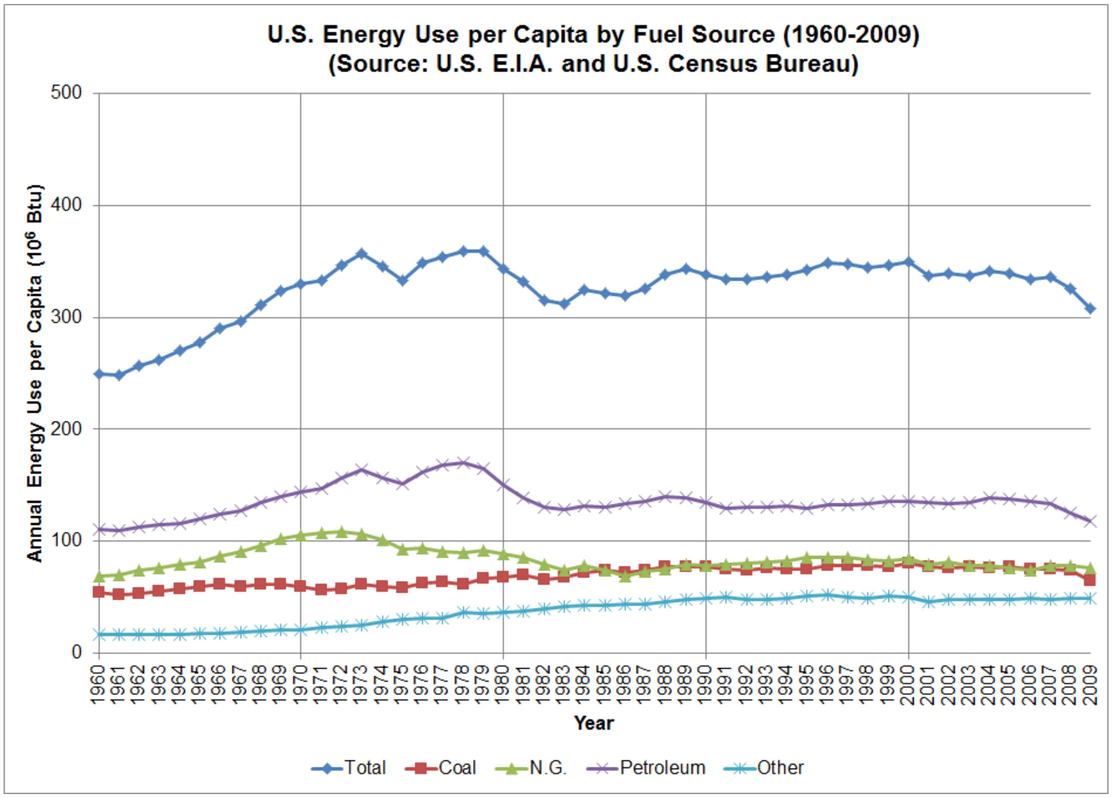


Figure 197: U.S. Total Energy Use per Capita by Fuel Source during 1960-2009.

9.9.3 Texas

Figure 198and Figure 199, respectively, show the total and per capita energy use of Texas by the end-use sector during the period of 1960 to 2009. Figure 200and Figure 201, respectively, show the total and per capita energy use of Texas by fuel sources during the period of 1960 to 2009. Texas's total energy use has been continuously rising, while per capita energy use has remained constant. Since 2000, per capita energy use in Texas has started decreasing. Texas' energy use per capita is still far beyond the U.S. average per capita. The industrial sector consumed the largest amount of total energy among end-use sectors, followed by electric power, transportation, residential and commercial. By fuel source, the energy consumption of petroleum-based products occupied the largest proportion of total, followed by natural gas, coal, and other fuel sources. It is noticeable that the energy consumption of natural gas products has suddenly decreased since 2004.

The total population and energy use information for Texas in 2009 is as follows:

- Texas Total Population (2009): 24,770,651
- Texas Total Energy Use (Quads=10^{15} Btu, 2009): 11.30 Quads s

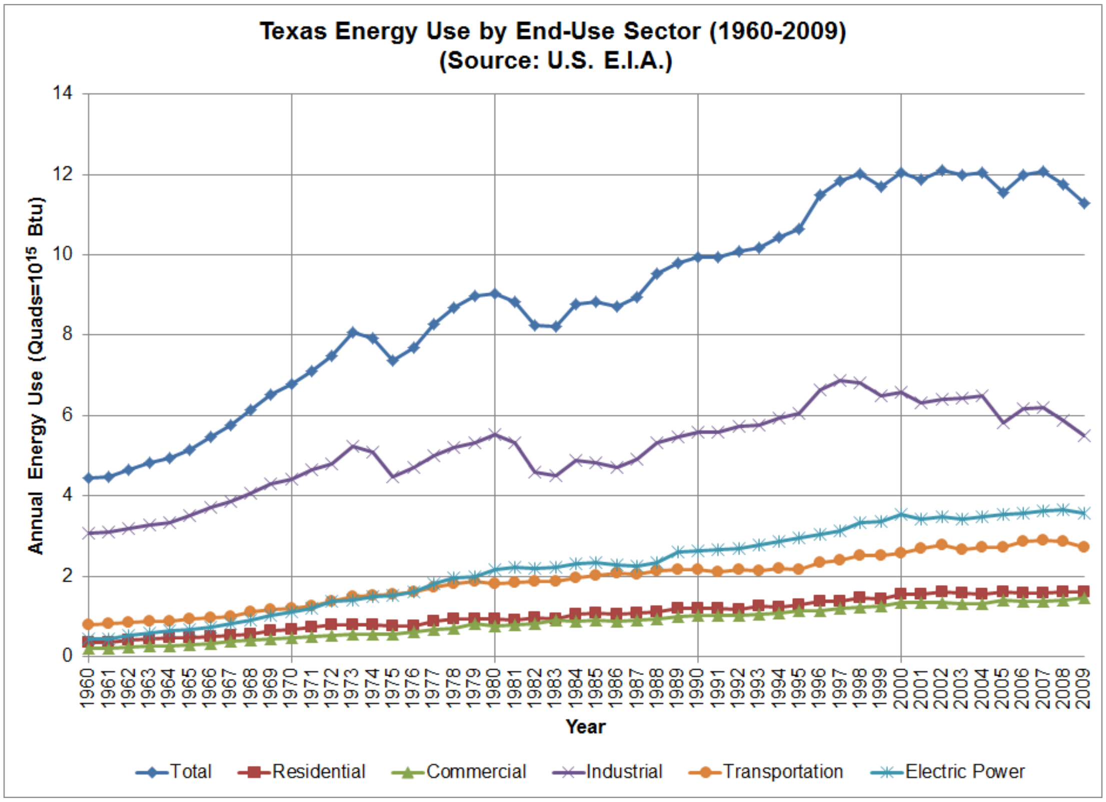


Figure 198: Texas Energy Use by End-Use Sector during 1960-2009.

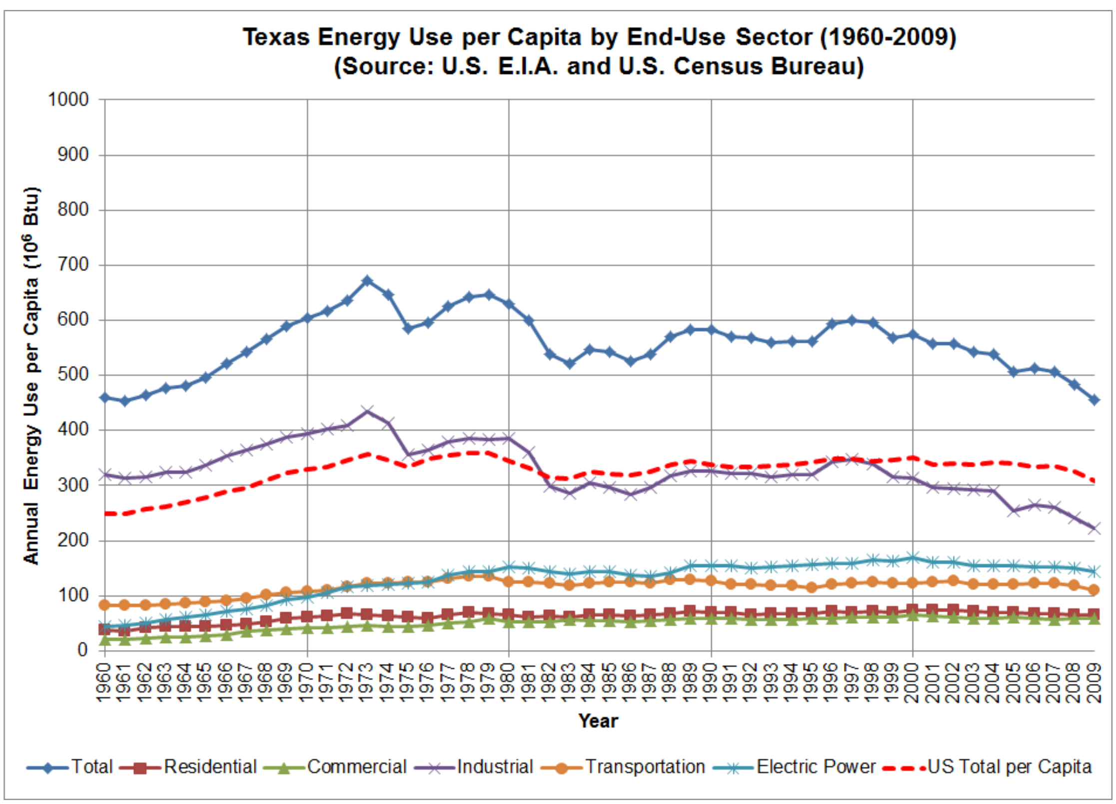


Figure 199: Texas Energy Use per Capita by End-Use Sector during 1960-2009.

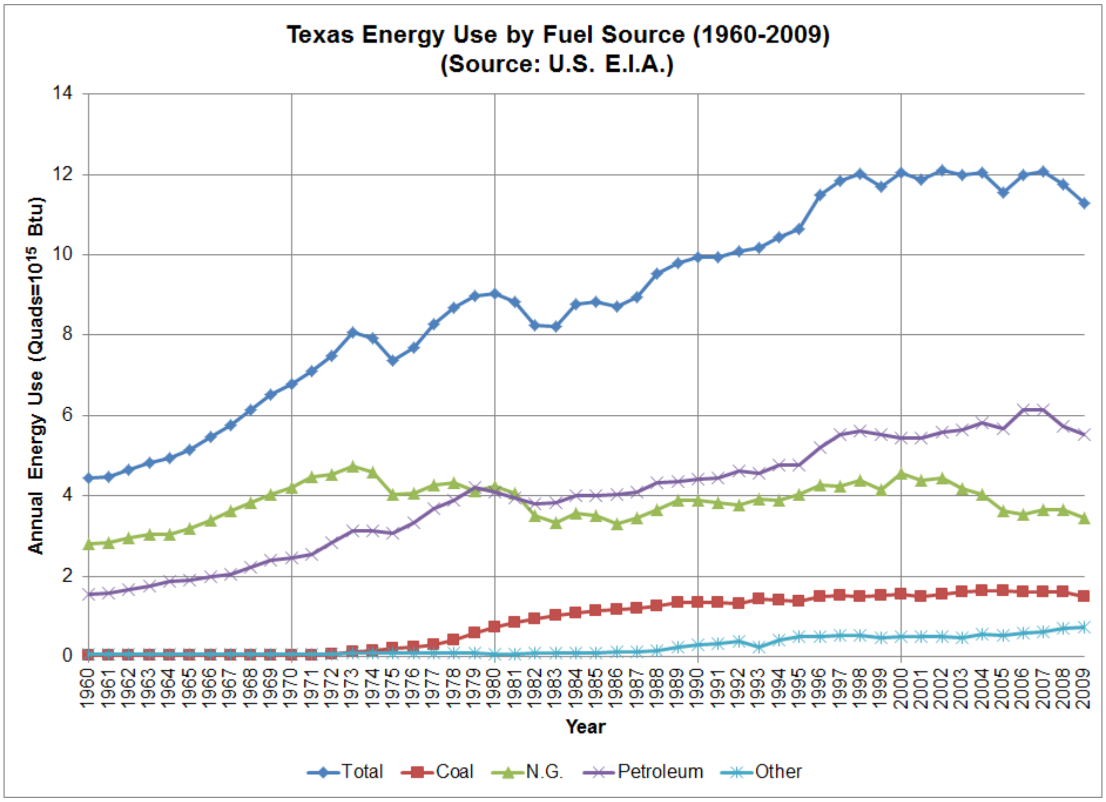


Figure 200: Texas Energy Use by Fuel Source during 1960-2009.

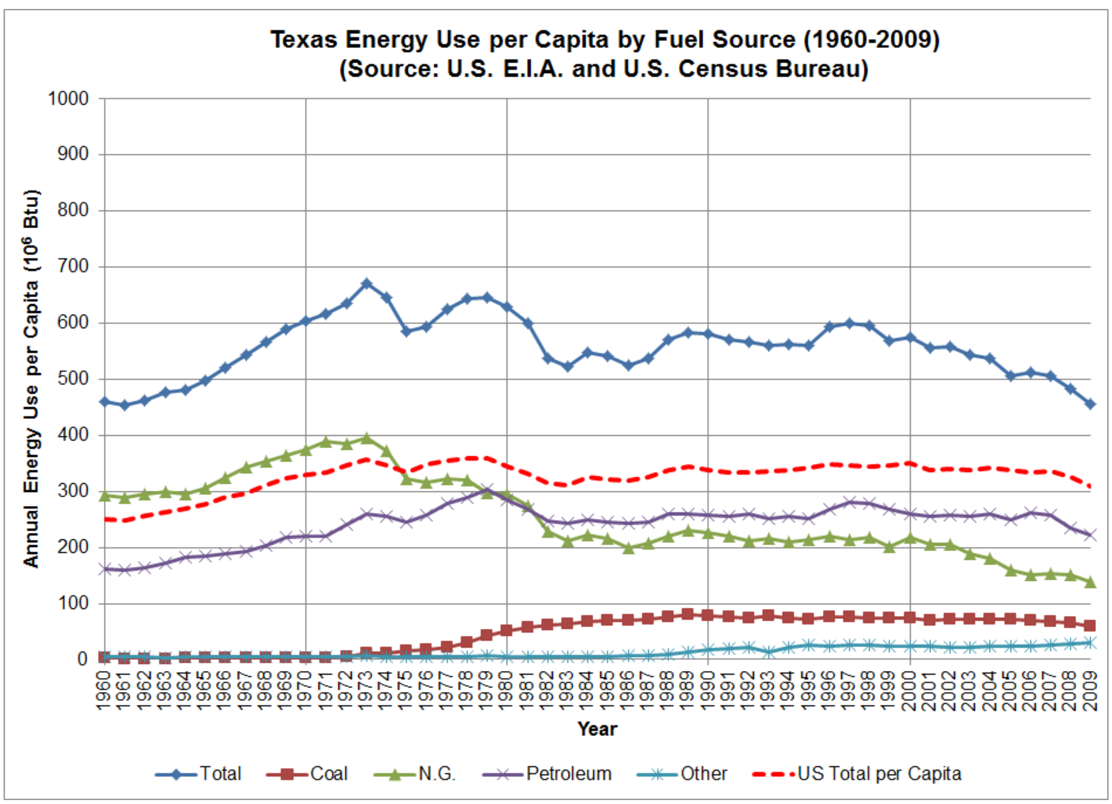


Figure 201:. Texas Energy Use per Capita by Fuel Source during 1960-2009.

9.10 APPENDIX A. Energy Consumption Data.

Appendix A presents the detailed information of energy consumption data sets that have been used for this analysis, including the source, selected data codes, and term definitions. The energy consumption data is taken from the U.S. DOE EIA's State Energy Data System (SEDS) website.

- Energy Consumption Data Sources:
  U.S. DOE, EIA. 2011. *Consumption, Price, and Expenditure Estimates through 2009: Complete Data Files, All States and All Years*, State Energy Data System (SEDS), Energy Information Administration, U.S. Department of Energy, Retrieved from http://www.eia.doe.gov/emeu/states/_seds.html (accessed June 30, 2011).

- 2009 is the latest year for which state-by-state energy consumption data is available. Among 276 data codes, the selected data codes are presented in Table 72. The EIA definitions of several terms, which are specific to this report, are presented in Table 73.

- A new data series "Other (Other Fuel Source)," including nuclear electric power, hydro-electric power, biomass, geothermal, wind, photovoltaic, solar thermal energy, and net imports of electricity, has been defined to display annual energy consumption by fuel source using the following equation:

  Other = TETCB - CLTCB - NNTCB - PATCB - ELISB

  where:

  TETCB: Total energy consumed.
  CLTCB: Coal total consumed.
  NNTCB: Natural gas total consumed.
  PATCB: All petroleum products total consumed.
  ELISB: Net interstate sales of electricity and associated losses.

- For the natural gas based energy consumption, "NNTCB (Natural gas total consumed (excluding supplemental gaseous fuels))" was used instead of "NGTCB (Natural gas total consumed (including supplemental gaseous fuels))" because NGTCB is no longer published.

Table 73: Selected Energy Consumption Data Codes

MSN	Description	Unit
TETCB	Total energy consumed.	Billion Btu
TERCB	Total energy consumed by the residential sector.	Billion Btu
TECCB	Total energy consumed by the commercial sector.	Billion Btu
TEACB	Total energy consumed by the transportation sector.	Billion Btu
TEICB	Total energy consumed by the industrial sector.	Billion Btu
TEEIB	Total energy consumed by the electric power sector.	Billion Btu
CLTCB	Coal total consumed.	Billion Btu
NNTCB	Natural gas total consumed (excluding supplemental gaseous fuels).	Billion Btu
PATCB	All petroleum products total consumed.	Billion Btu
ELISB	Net interstate sales of electricity and associated losses (negative and positive values).	Billion Btu

Table 74: EIA Term Definitions

Term	Definition
Residential Sector	An energy-consuming sector that consists of living quarters for private households. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances. The residential sector excludes institutional living quarters.
Commercial Sector	An energy-consuming sector that consists of service-providing facilities and equipment of: businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters. It also includes sewage treatment facilities. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a wide variety of other equipment. *Note*: This sector includes generators that produce electricity and/or useful thermal output primarily to support the activities of the above-mentioned commercial establishments.
Transportation Sector	An energy-consuming sector that consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another. Included are automobiles; trucks; buses; motorcycles; trains, subways, and other rail vehicles; aircraft; and ships, barges, and other waterborne vehicles. Vehicles whose primary purpose is not transportation (e.g., construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts) are classified in the sector of their primary use. In this report, natural gas used in the operation of natural gas pipelines is included in the transportation sector.
Industrial Sector	An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing (NAICS codes 31-33); agriculture, forestry, fishing and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products. Note: This sector includes generators that produce electricity and/or useful thermal output primarily to support the above-mentioned industrial activities.
Electric Power Sector	An energy-consuming sector that consists of electricity-only and combined-heat-and-power (CHP) plants within the NAICS (North American Industry Classification System) 22 categories whose primary business is to sell electricity, or electricity and heat, to the public. Note: This sector includes electric utilities and independent power producers.

9.11 APPENDIX B. Population Data.

Appendix B presents the detailed information of population data sets that have been used for this analysis, including the source. The population data used to calculate per capita energy use is taken from the U.S. Census Bureau website. For the intercensal estimates of the total resident population of each state, the reference date is July 1 of each year. For the period of 1960 through 1999, the same data is also available in the U.S. DOE EIA's State Energy Data System (SEDS) website under the data code "TPOPP (Resident population including Armed Forces)." In this analysis different data were used for the period of 2000 through 2009 to reflect a more recent estimation of the population. The population estimation data from 2000 to 2009 are shown in Table 74.

- Population Data Sources:

1960-1969: U.S. Department of Commerce, U.S. Census Bureau. 1996. *Intercensal Estimates of the Total Resident Population of States: 1960 to 1970*, State Population Estimates, 1900 to 1990, U.S. Census Bureau, Retrieved from http://www.census.gov/popest/archives/1980s/st6070ts.txt (accessed April 24, 2009).

1970: U.S. Department of Commerce, U.S. Census Bureau. 1979. *Statistical Abstract of the United States,* Section 1Population, "No. 11. Resident Population-States: 1960 to 1978." U.S. Census Bureau.

1971-1979: U.S. Department of Commerce, U.S. Census Bureau. 1995. *Intercensal Estimates of the Total Resident Population of States: 1960 to 1970*, State Population Estimates, 1970 to 1980, U.S. Census Bureau, Retrieved from http://www.census.gov/popest/archives/1980s/st7080ts.txt (accessed April 24, 2009).

1980: U.S. Department of Commerce, U.S. Census Bureau, 1995. *RESIDENT POPULATION OF STATES (by 5-year age groups & sex)*, U.S. Census Bureau, Retrieved from http://www.census.gov/popest/archives/1980s/s5yr8090.txt (accessed February 2, 2009).

1981-1989: U.S. Department of Commerce, U.S. Census Bureau. 1996. *Intercensal Estimates of the Total Resident Population of States: 1980 to 1990*, State Population Estimates, 1900 to 1990, U.S. Census Bureau, Retrieved from http://www.census.gov/popest/archives/1980s/st8090ts.txt (accessed April 24, 2009).

1990-1999: U.S. Department of Commerce, U.S. Census Bureau, *Time Series of Intercensal Estimates by County*, Intercensal Estimates, U.S. Census Bureau, Retrieved from http://www.census.gov/popest/archives/2000s/vintage_2001/CO-EST2001-12/index.html (accessed April 24, 2009).

2000-2009: U.S. Department of Commerce, U.S. Census Bureau. 2009. *Annual Population Estimates 2000 to 2009: Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2009*, National and State Population Estimates, U.S. Census Bureau, Retrieved from http://www.census.gov/popest/states/NST-ann-est.html (accessed Jun 30, 2011).

Table 75: Population Estimates by States: 2000 through 2009.

Table 1. Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2009

Geographic Area	Population Estimates										April 1, 2000	
	July 1, 2009	July 1, 2008	July 1, 2007	July 1, 2006	July 1, 2005	July 1, 2004	July 1, 2003	July 1, 2002	July 1, 2001	July 1, 2000	Estimates Base	Census
United States	307,006,550	304,374,846	301,579,895	298,593,212	295,753,151	293,045,739	290,326,418	287,803,914	285,081,556	282,171,957	281,424,602	281,421,906
Northeast	55,283,679	55,060,196	54,879,379	54,710,026	54,598,185	54,514,298	54,364,452	54,167,735	53,930,017	53,667,506	53,594,828	53,594,378
Midwest	66,836,911	66,595,597	66,359,247	66,082,058	65,806,421	65,587,713	65,319,024	65,074,729	64,815,413	64,493,956	64,395,190	64,392,776
South	113,317,879	112,021,022	110,573,419	108,930,843	107,411,036	105,874,018	104,431,612	103,185,017	101,868,637	100,559,939	100,235,832	100,236,820
West	71,568,081	70,698,031	69,767,850	68,870,285	67,937,509	67,069,710	66,211,330	65,376,433	64,467,489	63,450,556	63,198,752	63,197,932
Alabama	4,708,708	4,677,464	4,637,904	4,597,688	4,545,049	4,512,190	4,490,591	4,472,420	4,464,034	4,451,849	4,447,382	4,447,100
Alaska	698,473	688,125	682,297	677,325	669,488	661,569	650,884	642,691	633,316	627,499	626,931	626,932
Arizona	6,595,778	6,499,377	6,362,241	6,192,100	5,974,834	5,759,425	5,591,206	5,452,108	5,304,417	5,166,697	5,130,607	5,130,632
Arkansas	2,889,450	2,867,764	2,842,194	2,815,097	2,776,221	2,746,161	2,722,291	2,704,732	2,691,068	2,678,288	2,673,386	2,673,400
California	36,961,664	36,580,371	36,226,122	35,979,208	35,795,255	35,558,419	35,251,107	34,876,194	34,485,623	33,994,571	33,871,648	33,871,648
Colorado	5,024,748	4,935,213	4,842,259	4,753,044	4,660,780	4,599,681	4,548,775	4,504,265	4,433,068	4,328,070	4,302,015	4,301,261
Connecticut	3,518,288	3,502,932	3,488,633	3,485,162	3,477,416	3,474,610	3,467,673	3,448,382	3,428,433	3,411,726	3,405,607	3,405,565
Delaware	885,122	876,211	864,896	853,022	839,906	826,639	814,905	804,131	794,620	786,411	783,557	783,600
District of Columbia	599,657	590,074	586,409	583,978	582,049	579,796	577,777	579,585	578,042	571,744	572,055	572,059
Florida	18,537,969	18,423,878	18,277,888	18,088,505	17,783,868	17,375,259	16,981,183	16,680,309	16,353,869	16,047,118	15,982,839	15,982,378
Georgia	9,829,211	9,697,838	9,533,761	9,330,086	9,097,428	8,913,676	8,735,259	8,585,535	8,419,594	8,230,161	8,186,781	8,186,453
Hawaii	1,295,178	1,287,481	1,276,832	1,275,599	1,266,117	1,252,782	1,239,298	1,228,069	1,218,305	1,211,566	1,211,538	1,211,537
Idaho	1,545,801	1,527,506	1,499,245	1,464,413	1,425,862	1,391,718	1,364,109	1,342,149	1,321,170	1,299,551	1,293,955	1,293,953
Illinois	12,910,409	12,842,954	12,779,417	12,718,011	12,674,452	12,645,295	12,597,981	12,558,229	12,507,833	12,437,645	12,419,658	12,419,293
Indiana	6,423,113	6,388,309	6,346,113	6,301,700	6,253,120	6,214,454	6,181,789	6,149,007	6,124,967	6,091,649	6,080,520	6,080,485
Iowa	3,007,856	2,993,987	2,978,719	2,964,391	2,949,450	2,941,358	2,932,799	2,929,264	2,929,424	2,928,184	2,926,380	2,926,324
Kansas	2,818,747	2,797,375	2,775,586	2,755,700	2,741,771	2,730,765	2,721,955	2,712,598	2,701,456	2,692,810	2,688,811	2,688,418
Kentucky	4,314,113	4,287,931	4,256,278	4,219,374	4,182,293	4,147,970	4,118,627	4,091,330	4,069,191	4,048,903	4,042,288	4,041,769
Louisiana	4,492,076	4,451,513	4,376,122	4,240,327	4,497,691	4,489,327	4,474,726	4,466,068	4,460,816	4,468,979	4,468,972	4,468,976
Maine	1,318,301	1,319,691	1,317,308	1,314,963	1,311,631	1,308,253	1,303,102	1,293,938	1,284,791	1,277,211	1,274,915	1,274,923
Maryland	5,699,478	5,658,655	5,634,242	5,612,196	5,582,520	5,542,659	5,496,708	5,439,913	5,375,033	5,310,579	5,296,544	5,296,486
Massachusetts	6,593,587	6,543,595	6,499,275	6,466,399	6,453,031	6,451,279	6,451,637	6,440,978	6,411,730	6,363,015	6,349,119	6,349,097
Michigan	9,969,727	10,002,486	10,050,847	10,082,438	10,090,554	10,089,305	10,066,351	10,038,767	10,006,093	9,955,308	9,938,492	9,938,444
Minnesota	5,266,214	5,230,567	5,191,206	5,148,346	5,106,560	5,079,344	5,047,862	5,017,458	4,982,813	4,933,958	4,919,492	4,919,479
Mississippi	2,951,996	2,940,212	2,921,723	2,897,150	2,900,116	2,886,006	2,867,678	2,858,643	2,853,313	2,848,310	2,844,666	2,844,658
Missouri	5,987,580	5,956,335	5,909,824	5,861,572	5,806,639	5,758,444	5,714,847	5,680,852	5,643,986	5,606,065	5,596,684	5,595,211
Montana	974,989	968,035	957,225	946,230	934,801	925,887	916,750	909,868	905,873	903,293	902,190	902,195
Nebraska	1,796,619	1,781,949	1,769,912	1,760,435	1,751,721	1,742,184	1,733,680	1,725,083	1,717,948	1,713,345	1,711,265	1,711,263
Nevada	2,643,085	2,615,772	2,567,752	2,493,405	2,408,804	2,328,703	2,236,949	2,166,214	2,094,509	2,018,211	1,998,260	1,998,257
New Hampshire	1,324,575	1,321,872	1,317,343	1,311,894	1,301,415	1,292,766	1,281,871	1,271,163	1,256,879	1,240,446	1,235,791	1,235,786
New Jersey	8,707,739	8,663,398	8,636,043	8,623,721	8,621,837	8,611,530	8,583,481	8,544,115	8,489,469	8,430,921	8,414,378	8,414,350
New Mexico	2,009,671	1,986,763	1,968,731	1,942,608	1,916,538	1,891,829	1,869,683	1,850,035	1,828,809	1,820,813	1,819,041	1,819,046
New York	19,541,453	19,467,789	19,422,777	19,356,564	19,330,891	19,297,933	19,231,101	19,161,873	19,088,978	18,998,044	18,976,811	18,976,457
North Carolina	9,380,884	9,247,134	9,064,074	8,866,977	8,669,452	8,531,283	8,416,451	8,316,617	8,203,451	8,079,383	8,046,406	8,049,313
North Dakota	646,844	641,421	638,202	636,771	635,365	636,303	632,809	633,617	636,267	641,200	642,195	642,200
Ohio	11,542,645	11,528,072	11,520,815	11,492,495	11,475,262	11,464,593	11,445,180	11,420,981	11,396,874	11,363,844	11,353,150	11,353,140
Oklahoma	3,687,050	3,644,025	3,612,186	3,574,334	3,532,769	3,514,449	3,498,687	3,484,754	3,464,729	3,453,943	3,450,638	3,450,654
Oregon	3,825,657	3,782,991	3,732,957	3,677,545	3,617,869	3,573,505	3,550,180	3,517,111	3,470,382	3,430,891	3,421,437	3,421,399
Pennsylvania	12,604,767	12,566,368	12,522,531	12,471,142	12,418,161	12,388,368	12,357,524	12,326,302	12,299,533	12,285,504	12,281,071	12,281,054
Rhode Island	1,053,209	1,053,502	1,055,009	1,060,196	1,064,989	1,071,414	1,071,504	1,066,034	1,058,051	1,050,736	1,048,315	1,048,319
South Carolina	4,561,242	4,503,280	4,424,232	4,339,399	4,256,199	4,201,306	4,146,474	4,103,934	4,062,701	4,023,570	4,011,832	4,012,012
South Dakota	812,383	804,532	797,035	788,519	780,084	774,283	766,975	762,107	758,983	755,694	754,835	754,844
Tennessee	6,296,254	6,240,456	6,172,862	6,089,453	5,995,748	5,916,762	5,856,522	5,803,306	5,755,443	5,703,243	5,689,276	5,689,283
Texas	24,782,302	24,304,290	23,837,701	23,369,024	22,801,920	22,418,319	22,057,801	21,710,788	21,332,847	20,945,963	20,851,818	20,851,820
Utah	2,784,572	2,727,343	2,663,796	2,583,724	2,499,637	2,438,915	2,379,938	2,334,473	2,291,250	2,244,314	2,233,204	2,233,169
Vermont	621,760	621,049	620,460	619,985	618,814	618,145	616,559	614,950	612,153	609,903	608,821	608,827
Virginia	7,882,590	7,795,424	7,719,749	7,646,996	7,563,887	7,468,914	7,373,694	7,283,541	7,191,304	7,104,533	7,079,048	7,078,515
Washington	6,664,195	6,566,073	6,464,979	6,372,243	6,261,282	6,184,289	6,113,262	6,056,187	5,987,785	5,911,122	5,894,143	5,894,121
West Virginia	1,819,777	1,814,873	1,811,198	1,807,237	1,803,920	1,803,302	1,802,238	1,799,411	1,798,582	1,806,962	1,808,344	1,808,344
Wisconsin	5,654,774	5,627,610	5,601,571	5,571,680	5,541,443	5,511,385	5,476,796	5,446,766	5,408,769	5,374,254	5,363,708	5,363,675
Wyoming	544,270	532,981	523,414	512,841	506,242	502,988	499,189	497,069	492,982	493,958	493,783	493,782
Puerto Rico	3,967,288	3,954,553	3,941,235	3,926,744	3,910,722	3,893,931	3,876,637	3,858,272	3,837,768	3,814,413	3,808,603	3,808,610

Note: The April 1, 2000 Population Estimates base reflects changes to the Census 2000 population from the Count Question Resolution program and geographic program revisions. See Geographic Terms and Definitions at http://www.census.gov/popest/geographic/ for a list of the states that are included in each region.

Suggested Citation:

Table 1. Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2009 (NST-EST2009-01)

Source: U.S. Census Bureau, Population Division

Release Date: December 2009

10 Planned Verification of the Calculators: eCALC, IC3 and AIM

As part of the analysis effort, verification and validation efforts are planned for each of the major analysis areas in the emissions calculator, including: on-site inspections and calibrated simulations.

10.1 On-site Inspections

On-site inspection work continued in 2010, including residential and commercial buildings to determine if specific energy-conserving features are being installed properly.

10.2 Calibrated Simulations

Calibrated simulations have been completed for two commercial sites and one residential site to help confirm the accuracy of the code-compliant DOE-2 simulations. For each site, existing data loggers, installed from previous projects were restarted and the data from the sensors checked for accuracy. These sites include a standard office building and a K-12 school in College Station, Texas.

10.2.1 Standard Office building

The calibrated simulation of a standard office building using the Texas A&M University Systems Building in College Station, Texas, continues. Figure 202 to Figure 203.

Figure 80 show the related information from this site. This building is currently being monitored as part of the campus energy conservation program. The goal with this site is to develop a calibrated simulation of the actual building (Figure 205), and a representative building (Figure 204), and then compare/contrast the savings differences between the calibrated model vs the representative model.

In May of 2008, a thesis entitled, “Methodology to Develop and Test an Easy-To-Use Procedure for the Preliminary Selection of High-Performance Systems for Office Buildings in Hot and Humid Climates” developed a procedure using the John Connally Building in College Station, Texas.

Figure 202: Standard Office Building (Texas A&M University Systems Building, College Station, Texas)

Figure 203: Standard Office Building (Texas A&M University Systems Building, College Station, Texas)

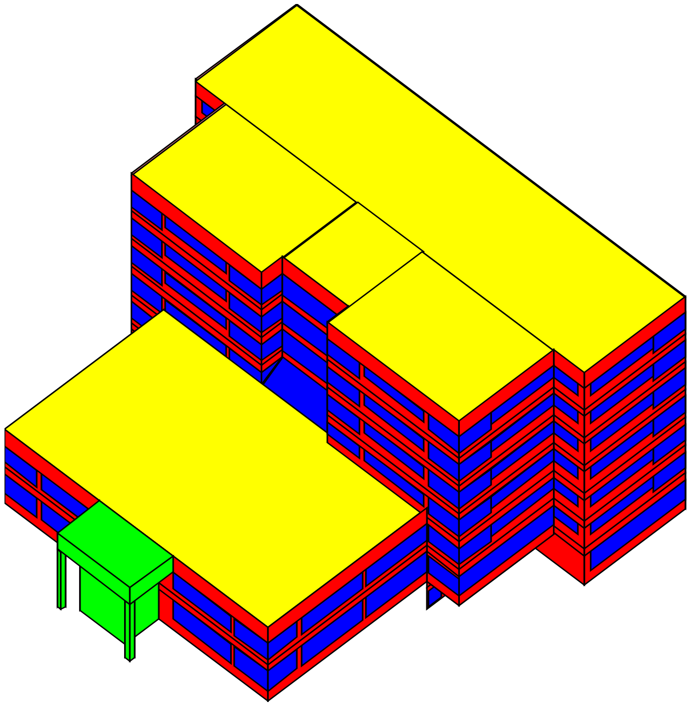


Figure 204: Computer Simulation (DOE-2.1E) of Case Study Office Building

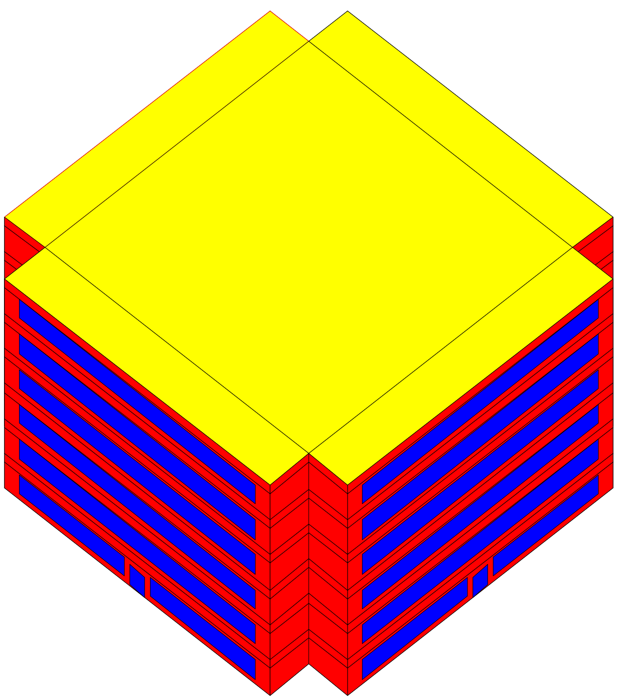


Figure 205: Computer Simulation (DOE-2.1E) of Base Case Office Building

Figure 206: Air Handling Unit in the 5th Floor of the John Connally Building

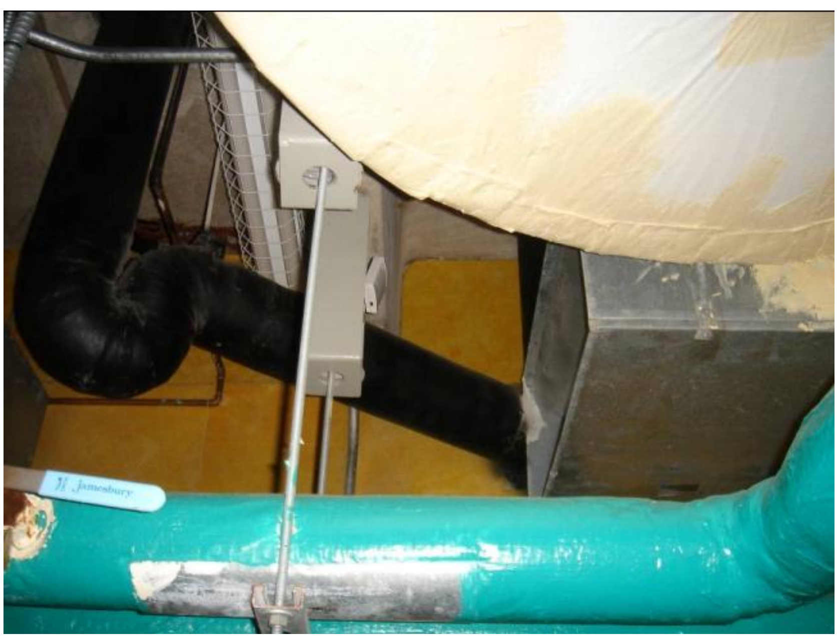


Figure 207: Installation of a Portable Logger to Measure the Return Air Temperature of an AHU on the 5th Floor

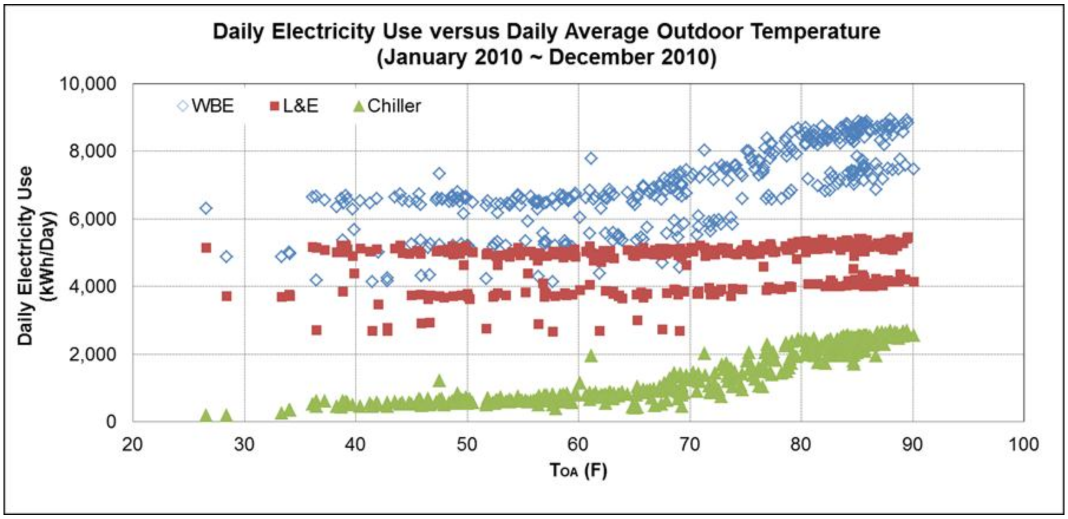
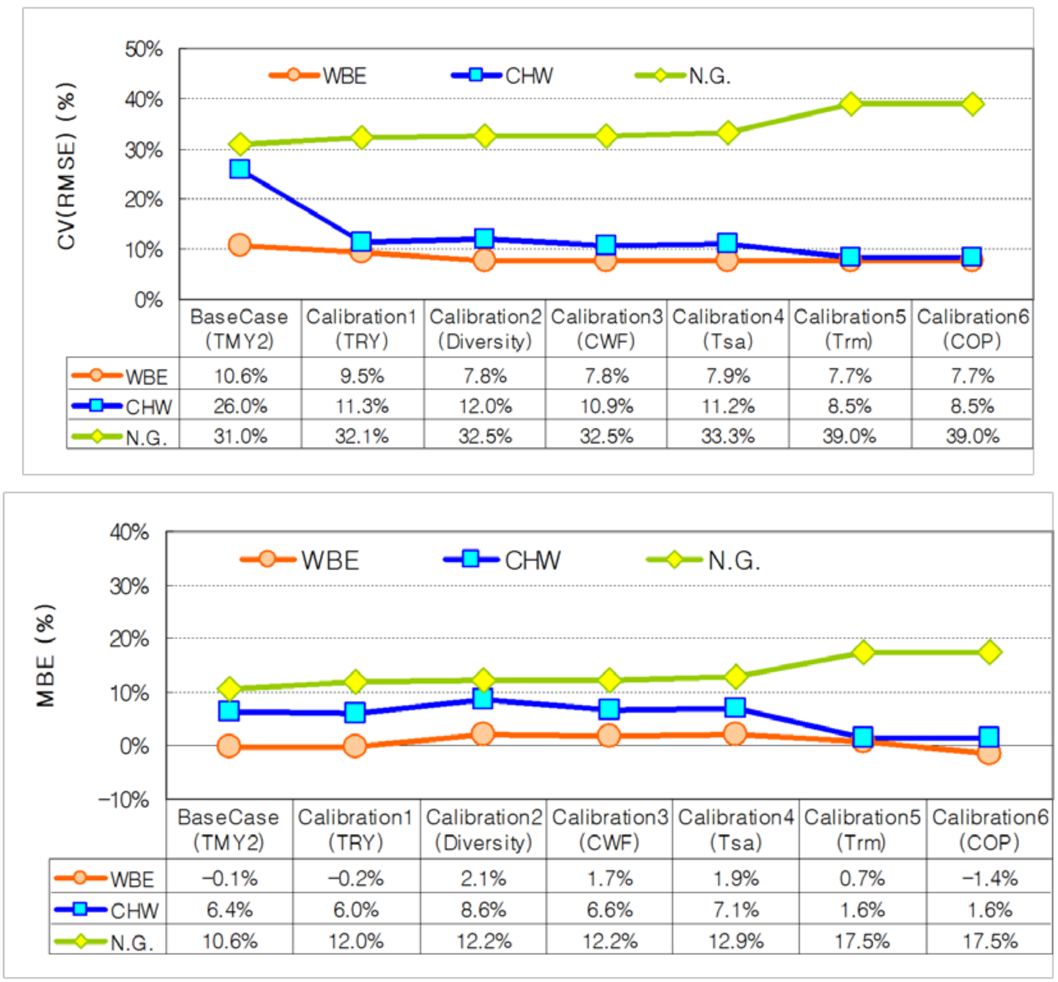


Figure 208 2010 Scatter Plots from the Data logger Installed in the Case Study Office Building



	BaseCase (TMY2)	Calibration1 (TRY)	Calibration2 (Diversity)	Calibration3 (CWF)	Calibration4 (Tsa)	Calibration5 (Trm)	Calibration6 (COP)
WBE	10.6%	9.5%	7.8%	7.8%	7.9%	7.7%	7.7%
CHW	26.0%	11.3%	12.0%	10.9%	11.2%	8.5%	8.5%
N.G.	31.0%	32.1%	32.5%	32.5%	33.3%	39.0%	39.0%

	BaseCase (TMY2)	Calibration1 (TRY)	Calibration2 (Diversity)	Calibration3 (CWF)	Calibration4 (Tsa)	Calibration5 (Trm)	Calibration6 (COP)
WBE	-0.1%	-0.2%	2.1%	1.7%	1.9%	0.7%	-1.4%
CHW	6.4%	6.0%	8.6%	6.6%	7.1%	1.6%	1.6%
N.G.	10.6%	12.0%	12.2%	12.2%	12.9%	17.5%	17.5%

Figure 209: Goodness of fit indicators for measured versus simulated data from office building

10.3 Solar Test Bench

This report deals with the different activities that were carried out to revitalize the old solar test bench. New sensors were added to the old existing sensors. The old synergistic data logger was replaced by the Campbell Scientifics' CR-1000 data logging system. The accessories required like battery backup system, multiplexer, Ethernet module, surge protection units were selected, purchased and installed. The physical installation of sensors and extra cabling required were done. The next step was to get the real time displays of logged data on a webpage.

10.3.1 General Setup

Figure 210 shows how the whole system is organized. It has three main clusters- the solar test bench cluster, the mechanical room cluster, and the Energy systems lab (ESL) cluster.

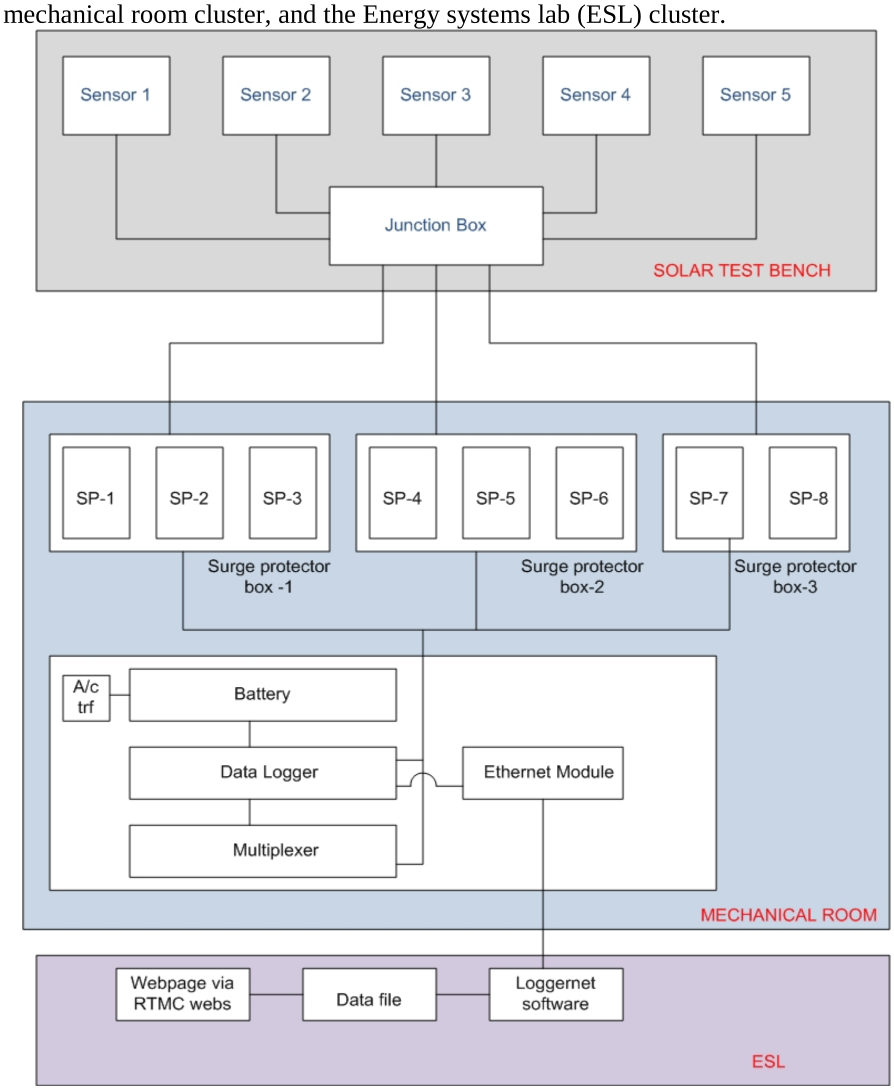


Figure 210 Schematic Diagram of the whole setup

10.3.1.1 The Solar Test Bench Cluster:

The solar test bench is the physical bench which acts as skeleton/base structure on which the whole sensors setup was installed on. All the weather sensors are installed on the solar test bench. The output of the weather sensors go into the main junction box. From the main junction box, the cables take the outputs of the sensors from the main junction box to the inside of the mechanical room. The cables pass through three intermediate junction boxes before they reach the mechanical room

10.3.1.2 The Mechanical Room Cluster

The mechanical room is the place where the data logger subassembly consisting of data logger, battery backup system, multiplexer& Ethernet module are installed. The outputs of the sensors (carried by the cables) go into this sub-assembly after passing through surge protectors.

The data logger is powered by a battery backup. The multiplexer connected to the data logger provides room for logging data from more sensors than the actual capacity of data logger alone. The Ethernet module which sits on the peripheral port of data logger and it enables communication between the mechanical room cluster and the Energy systems lab cluster. This data transfer is powered by an internet connection

10.3.1.3 The Energy Systems Lab Cluster

The data is downloaded at ESL by using the Logger net software. The Loggernet software communicates with the data logger through the internet connection via the Ethernet module.

The Logger net downloads the data according to the automated download schedule. The downloaded data is stored in a central location. The data in this central location is accessed by RTMCWebs software to display the real-time plots on the webpage.

10.4 The Solar Test Bench Cluster

This cluster consists of the following:

- Sensors used
- Position of sensors in the solar test bench
- Cables
- Main junction box

10.4.1 List of Sensors Used

The various sensors used are listed in Table 73. This table gives the type of each sensor used in the solar test bench, make, model, number of output wires along with the multipliers and offsets for measuring the variable the sensor intends to measure. The Table 74 shows the summary of different sensors used.

Table 76: List of sensors used

<table>
<tr><th>S.No</th><th>Sensor Type</th><th>Make</th><th>Model</th><th>No. of output wires</th><th>Multiplier</th><th>Offset</th></tr>
<tr><td>1</td><td>PSP-1</td><td>Eppley</td><td>PSP</td><td>2</td><td>125.63</td><td>0</td></tr>
<tr><td>2</td><td>PSP-2</td><td>Eppley</td><td>PSP</td><td>2</td><td>103.09</td><td>0</td></tr>
<tr><td>3</td><td>Li-Cor-4</td><td>Licor</td><td>Li-Cor</td><td>2</td><td>75.03</td><td>0</td></tr>
<tr><td>4</td><td>Li-Cor-1</td><td>Licor</td><td>Li-Cor</td><td>2</td><td>72.59</td><td>0</td></tr>
<tr><td>5</td><td>Li-Cor-3</td><td>Licor</td><td>Li-Cor</td><td>2</td><td>75.59</td><td>0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Anemometer-2</td><td rowspan="2">Met One</td><td rowspan="2">034B</td><td rowspan="2">6</td><td>1.789</td><td>0.629</td></tr>
<tr><td>NA</td><td>NA</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Anemometer-1</td><td rowspan="2">Met One</td><td rowspan="2">034B</td><td rowspan="2">6</td><td>1.789</td><td>0.629</td></tr>
<tr><td>712</td><td>0</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Temp/RH sensor-1</td><td rowspan="2">Vaisala</td><td rowspan="2">HMP45A</td><td rowspan="2">6</td><td>0.18</td><td>-40</td></tr>
<tr><td>0.1</td><td>0</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Temp/RH sensor-2</td><td rowspan="2">Vaisala</td><td rowspan="2">HMP45A</td><td rowspan="2">6</td><td>0.18</td><td>-40</td></tr>
<tr><td>0.1</td><td>0</td></tr>
<tr><td>10</td><td>NIP-1</td><td>Eppley</td><td>NIP</td><td>2</td><td>118.06</td><td>0</td></tr>
<tr><td>11</td><td>NIP-2</td><td>Eppley</td><td>NIP</td><td>2</td><td>117.79</td><td>0</td></tr>
<tr><td>12</td><td>B&W pyranometer-1</td><td>Eppley</td><td>8-48</td><td>2</td><td>96.99</td><td>0</td></tr>
<tr><td>13</td><td>B&W pyranometer-2</td><td>Eppley</td><td>8-48</td><td>2</td><td>98.62</td><td>0</td></tr>
</table>

Table 77: Summary of sensors used

S.No	Sensor Type	No. of sensors
1	Li-Cor	3
2	PSP	2
3	Anemometers	2
4	Temp/RH sensor	2
5	NIP	2
6	B&W pyranometer	2
	Total	**13**

10.4.2 LI-COR sensor

The LI-COR sensor is used to measure solar radiation. The current output by the LI-COR sensor is directly proportional to the solar radiation intensity.

Figure 211 LI-COR sensor

- The LI-COR pyranometers normally output low intensity current (ampere output)
- It uses a silicon photo-diode sensor
- Since we need mill volt output we connect a millivolt adapter in between the LI-COR sensor and the data logger, so that the data logger measures millivolts.
- The mill volt adapter used by us has a resistance of 147 ohms
- The total millivolt output by the LI-COR sensor would be current output times 147 (as per V=I*R rule)
- We have three LI-COR sensors in the revitalized solar test bench

Figure 212 Milivolt adapter

10.4.3 Precision Spectral Pyranometer (PSP)

The precision spectral pyranometer also measures solar radiation intensity. A PSP is a very accurate and high quality pyranometer. It is sometimes used to calibrate other pyranometers.

Figure 213 Precision Spectral Pyranometer (PSP)

- It comprises a circular multi-junction wire-wound Eppley thermopile which has the ability to withstand severe mechanical vibration and shock
- Included is a spirit level, adjustable leveling screws and a desiccator which can be readily inspected
- The instrument has a cast bronze body with a white enameled guard disk (shield) and comes with a transit/storage case
- A PSP outputs millivolt signals
- The PSP's used in the revitalized solar test bench was manufactured by EPPLEY Inc

10.4.4 Normal Incidence Pyrheliometer (NIP)

The Eppley Normal Incidence Pyrheliometer is a World Meteorological Organization first class Pyrheliometer designed, as its name implies, for the measurement of solar radiation at normal incidence.

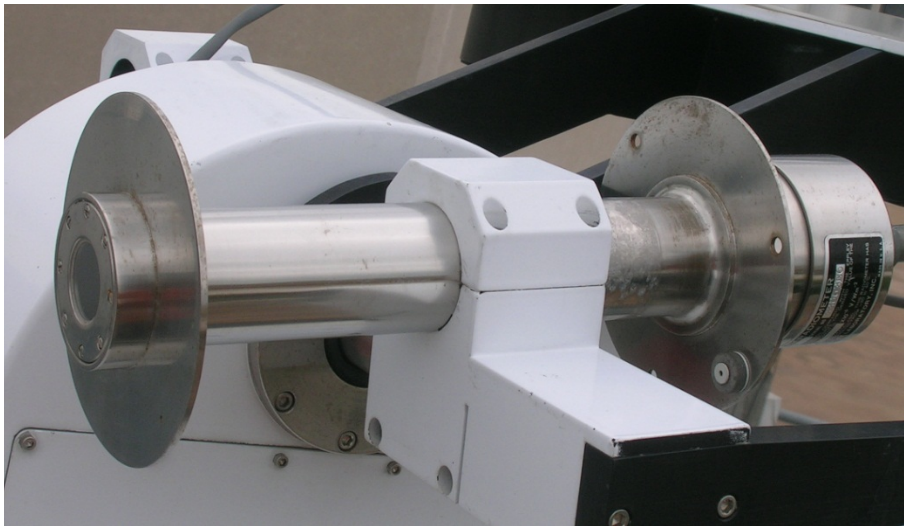


Figure 214 Normal Incidence Pyrheliometer (NIP)

- The NIP incorporates a wire-wound thermopile at the base of a tube, the aperture of which bears a ratio to its length of 1 to 10, subtending an angle of 5°43'30".
- The inside of this brass tube is blackened and suitably diaphragmed. The tube is filled with dry air at atmospheric pressure and sealed at the viewing end by an insert carrying a 1 mm thick, Infrasil II window
- Two flanges, one at each end of the tube, are provided with a sighting arrangement for aiming the Pyrheliometer directly at the sun
- The NIP is mounted on a solar tracker for continuously pointing the NIP onto the sun for continuous normal incidence solar radiation measurement.
- NIP outputs millivolt signals
- The NIP's used in the revitalized solar test bench was manufactured by EPPLEY Inc

10.5 B&W Pyranometers

The B&W pyranometers measure solar radiation intensity. It outputs millivolt signals

Figure 215 Black & White Pyranometer

- The Black and White Pyranometer has a detector consisting of a differential thermopile with the hot-junction receivers blackened and the cold-junction receivers whitened.
- The B&W Pyranometers used in the revitalized solar test bench was manufactured by EPPLEY Inc

10.6 Solar Tracker

The automatic solar tracker is a 2 axis, device programmed to align solar radiation instruments with the normal incidence of the sun from any position on the earth's surface

Figure 216 Solar Tracker

- The solar tracking is achieved using a computer program which calculates the solar position for the time and location and transmits pulses to the drives which then operate the 2 stepping motors.

- The stepping motors move the elevation and azimuth axes to the correct position.
- The instrument cables and motor drive cable are directed through the rotation axis and out to a stationary connector block to eliminate coiling.
- After initial installation, the tracker will continue to track the sun and reset during darkness. Only periodic resetting of the system clock is required
- The solar tracker holds all the pyrheliometers- NIP's, and PSP's, B&W pyranometers
- They hold the NIP's so that they are always normal to the solar radiation incidence at every point in time
- The solar tracker has a control box and a tracker system on which all the pyranometers are fixed
- The controller in the control box is supported by a palmtop computer, which does all the ephemeral calculations and determines the position of the tracker at each point in time

10.7 Anemometers

An Anemometer is a device used to measure wind speed. We use anemometers manufactured by Metone. Before October 2010, we use two different models.

- Metone 014A
- Metone 034B

Then, the one of Metone 014A has also been replaced by a Metone 034B model.

10.8 Metone 014A

The Metone 014A model is used to measure only wind speed (no wind direction)

Figure 217 Anemometer Metone 014A

- Only the best corrosion resistant materials, such as stainless steels and anodized aluminum are used.
- The 014A is a three cup anemometer that is used to measure horizontal wind speed
- Rotation of the cup wheel opens and closes a reed switch at a rate proportional to wind speed. As the vanes turn they operate a reed switch which opens and closes
- The frequency of opening and closing of the reed switch is measured by using the data logger which in turn is translated to wind speed
- It can measure up to 100 mph

10.9 Metone 034B

The Metone 034B can measure both wind speed and wind direction.

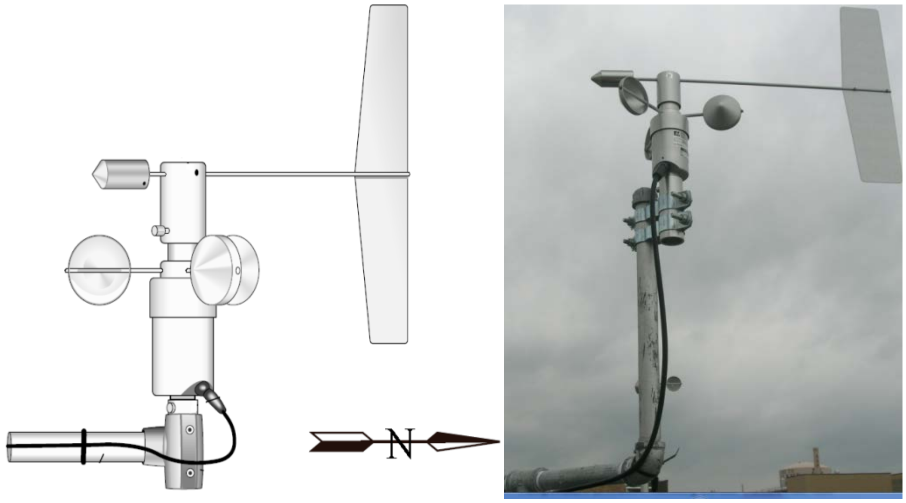


Figure 218 Anemometer Metone 034B

- The principle of operation of the Metone 034B wind speed sensor is same as the 014A
- It has an additional sensor to measure wind direction which is a part of the same unit
- The wind direction sensor consists of a wind vane. This wind vane is coupled to a 10K ohm potentiometer. The sensor outputs millivolts in proportion to the direction.
- The arm which holds the total sensor unit should be along the true north-south line

10.10 Temperature &Relative Humidity sensor-Vaisala HMP45A

This single unit can measure both temperature and relative humidity. It has two separate sensors for temperature and relative humidity

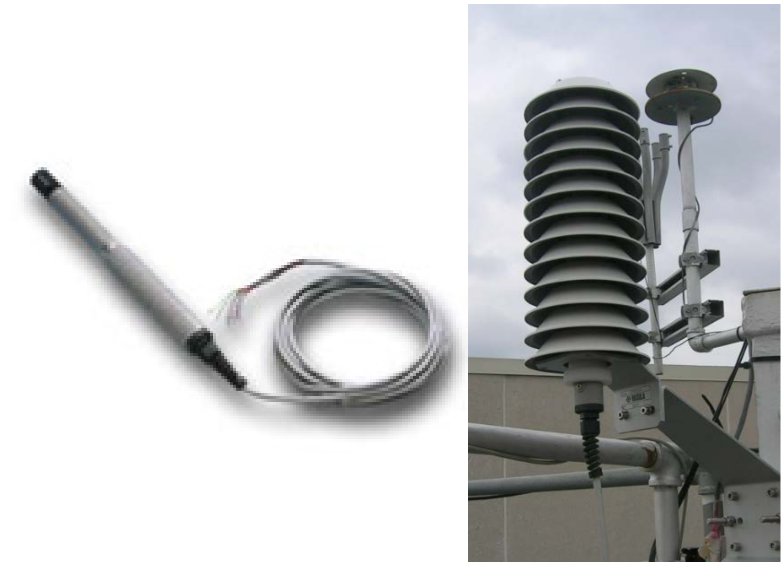


Figure 219 Temp& Rel Humidity Sensor-Vaisala HMP 45A

- Both sensors output millivolt signals according to the variables they measure
- Humidity measurement is based on the capacitive thin film polymer sensor HUMICAP180
- Temperature measurement is based on resistive platinum sensors
- Both the temperature and humidity sensors are located at the tip of the probe and in standard version protected by a membrane filter
- The sensors use radiation shield to block solar radiation and to allow air to pass through easily.
- The radiation shield uses multiple discs as shown in the above figure

10.11 Positions of Sensors in the Solar Test Bench

The following figure shows the position of the different installed sensors in the solar test bench.

- The anemometers are fitted on to metal pipe extensions extending from the bench
- The temperature and relative humidity sensors are fitted on the bench with brackets
- Three of the four LI-COR sensors are fitted in a box and made to expose to the solar radiation
- The PSP's are fit in a way that there is nothing that obstructs it from the solar radiation
- The NIP is fitted onto the solar tracker
- Also shown is the old junction box and just behind it and not so clear is the new junction box

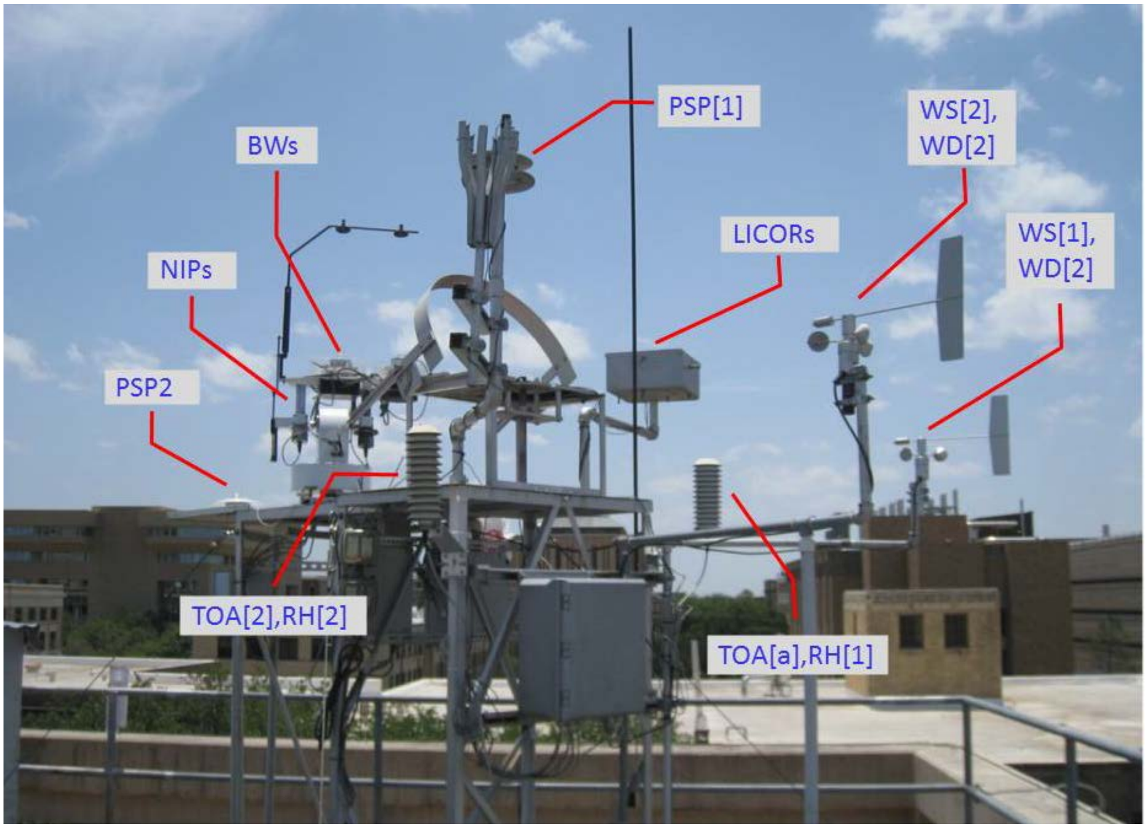


Figure 220 Position of all sensors in solar test bench

10.12 Cables-type and Specification

- Houston wire company make
- 8 conductors per cable
- 6 wires per conductor
- Shielded
- 22 AWG
- PVC outer coating
- No of cables-3

10.13 Junction Box

The new junction box is fit directly behind the new junction box.

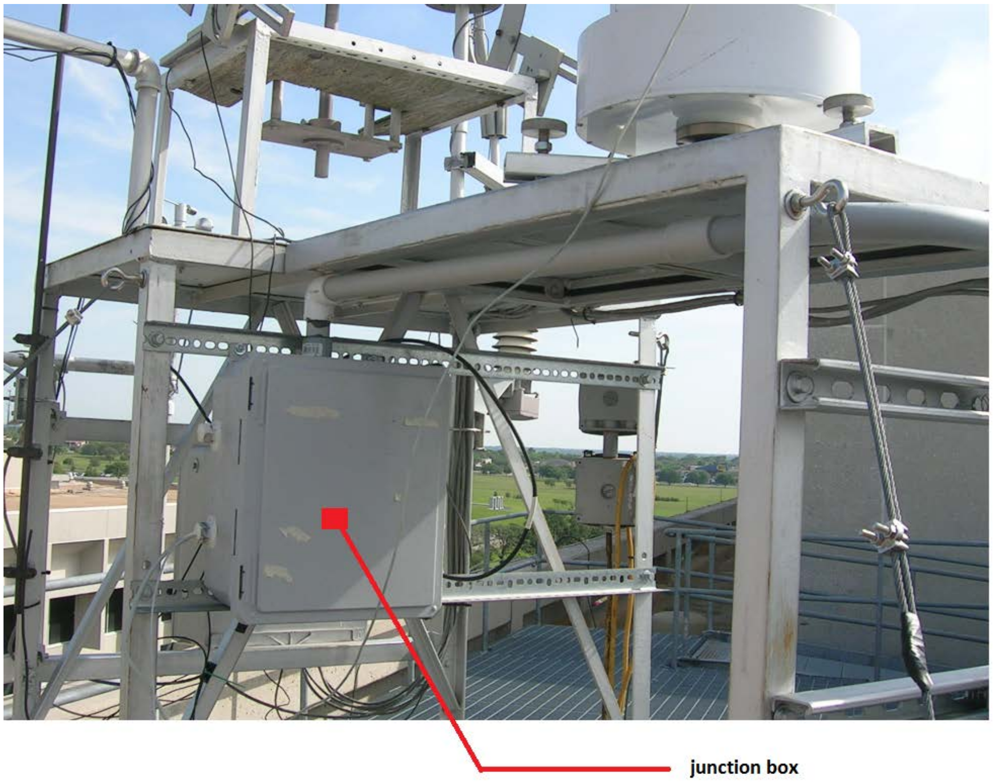


Figure 221 Junction Box-picture 1

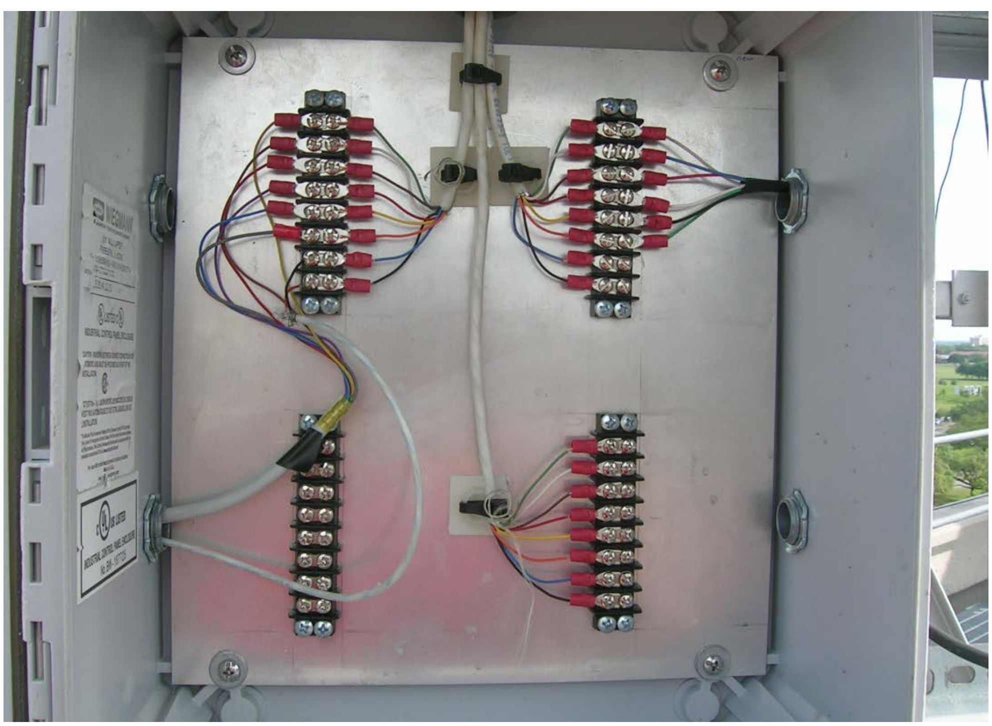


Figure 222 Junction Box- Picture 2

- The new junction box is the main junction between the sensors and the surge protectors in the mechanical room
- The position of the new junction box is as shown
- The junction box is air and water tight and NEMA 4 rating
- Proper sealant (silicone based) has been used to provide water tightness at sensor wire entry and exit points
- It has provisions for 4 wire connection strips (8 conductors each)
- The cables in the new junction box connects to the data logger after passing through the surge protectors in the mechanical room
- The cable reach the surge protectors after passing through PVC piping and 3 intermediate junction boxes
- one of the intermediate junction boxes is just under the solar test bench and two boxes at the entry of the mechanical room
- The intermediate junction boxes have been provided only for inspection –there are no connections in them

Figure 223 Intermediate junction box with pvc piping

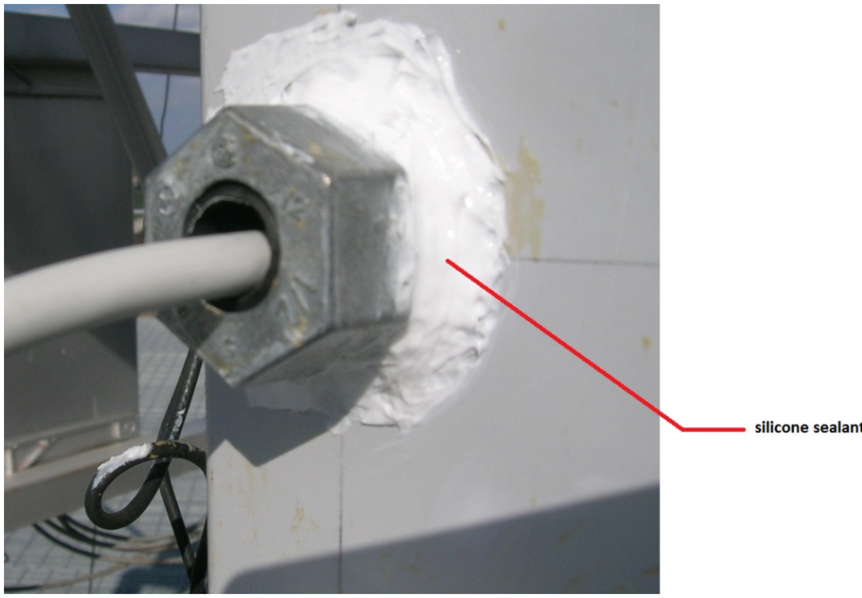


Figure 224 Usage of sealant in junction box

10.14 The Mechanical Room Cluster

This section consists of

- An overview of installation inside the mechanical room
- Various devices/components used
    - Surge protectors
    - Data logger
    - Battery Backup
    - Multiplexer
    - Ethernet
- A Connections between the various components/devices
- Data logger program-an overview
- Changes done to accommodate the solar radiation sensors in the new data logging system

10.15 An Overview of Installation Inside The Mechanical Room

The following figure shows the installation of various components and devices inside the mechanical room.

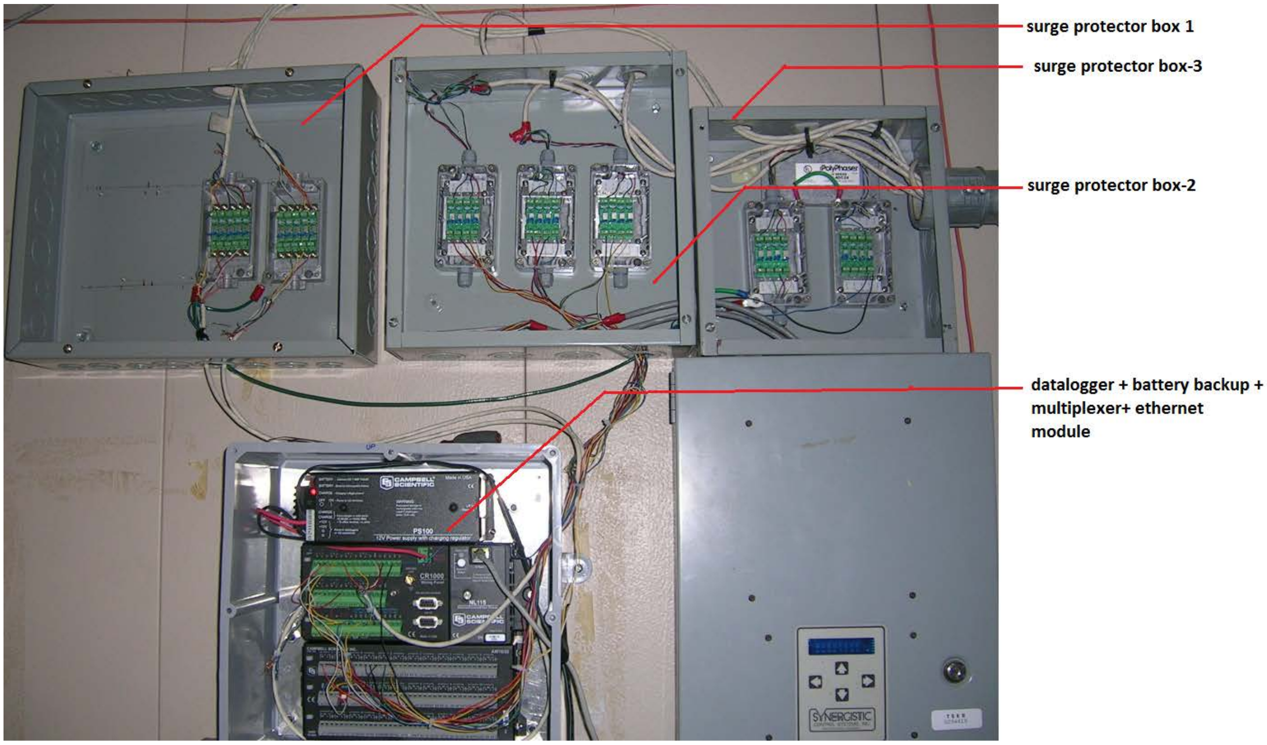


Figure 225 Inside mechanical room

- The PVC conduit leads the cables into the mechanical room
- The cables then go through the surge protector boxes and from there on to the data logger
- There are three surge protector boxes
- From the surge protector box cable leads go to a box which contains all other components-the battery backup, data logger, multiplexer and Ethernet module together

10.16 Various Components and Devices

10.16.1 Surge Protectors-Specification And Installation

The surge protectors protect the data logger from a sudden surge in voltage that passes through into the data logger from the sensor outputs (there can be a surge in voltage in case of a lightning strike).

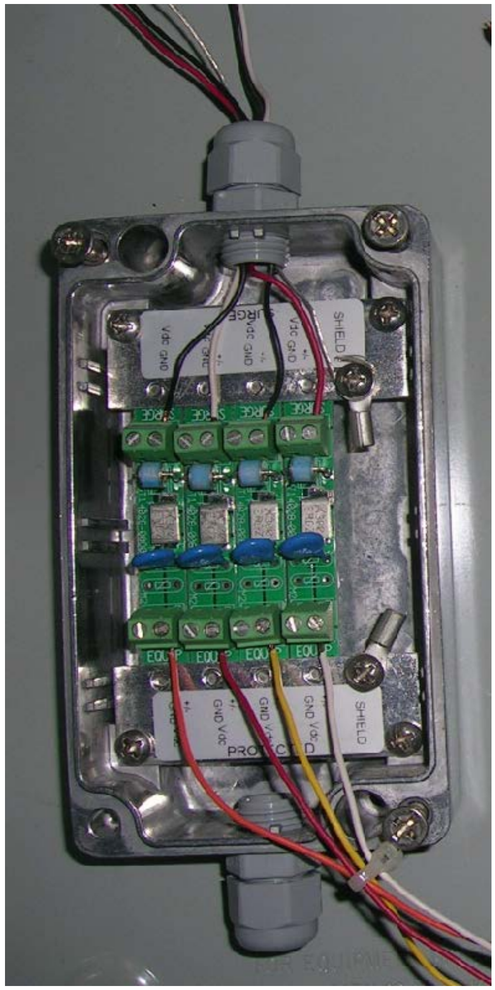


Figure 226: Surge Protector-IX-5DC24

- The surge protectors open the circuit in case of a surge in voltage
- The surge protectors are used between the sensors and the data logger
- The model used is IX-5DC24 –Poly phaser make
- Maximum input voltage of 24VDC
- Has provision for 5 conductors per unit

10.17 Datalogger

The data logger measures the outputs from the sensors. The outputs from the sensors can either be millivolts or pulses. The measurements and logging are as per instructions in a CR-basic program –which is initially sent to a data logger.
The data thus logged is stored with a time stamp in the internal memory of the data logger. Then a computer loaded with logger net software, tries to connect with the data logger and the data is downloaded to the computer from the data logger's memory.

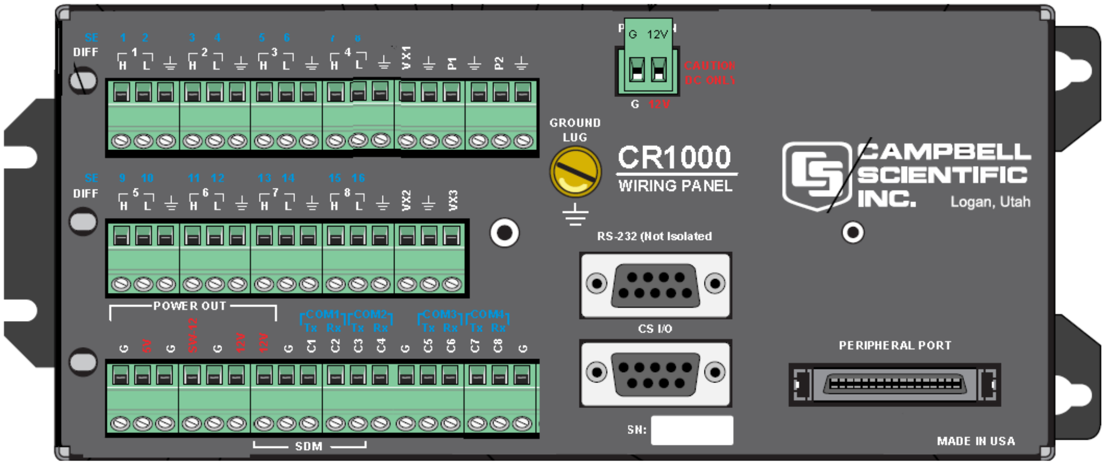


Figure 227: Data logger CR-1000

Features of data logger used in the revitalized solar test bench

- Campbell scientific make ,model CR-1000
- Program execution rate 10ms to 30 minutes
- Can log mill volt or pulse(frequency) signals
- Measurable Voltage range is +/- 5v
- Maximum measurable input frequency is 250 KHz
- Works satisfactorily in the range of -25 °C to +50 °C
- Input voltage required is 12V DC
- Battery backup (PS100-Campbell scientific make) available
- Ethernet module (NL115-Campbell scientific make) when used with this data logger enables logging of data over the internet
- The Ethernet module has a pocket for a memory card which can be used to store data. The use of memory card for storing data is optional.
- A total of 8 two/three legged sensors could be used for measurement with the data logger
- A multiplexer (AM16/32B Campbell scientific make) when used along with the data logger enables an increase in the no of sensors that can be used for measurement
- A software program PC-400 is used in sync with the data logger to enable programming the data logger, collection and viewing of data etc.
- The sync with PC-400 can happen by connecting the data logger to a computer which has PC-400 running on it. The connection can either be direct (via RS-232 port on the data logger or via an Ethernet module NL-115 through the internet connection)
- An advanced version of PC-400 is the Logger net software which provides advanced features like automatic scheduled collection of data
- Use of advanced software like RTMC-pro and RTMC-web server along with Logger net can enable automatic and real time updating of the data and plots on the internet
- Backed by strong technical support of Campbell scientific via email/phone

10.18 Multiplexer-AM16/32B

Figure 228 Multiplexer Am16/32B

- Campbell scientific make
- Connected with CR-1000 to enable collection of data from more sensors
- A maximum of 32 two or three-legged sensors can be connected
- Two modes 2*32 or 4*16 (we use only 2*32 mode)
- Used along with CR-1000 data logger for collection of data

10.19 Battery Back-up

Figure 229 Battery Backup PS 100

- The battery back-up system used is PS100-Campbell Scientific make
- Input voltage 18VAC RMS
- Output voltage 12VDC
- The system uses an A/c transformer and a rechargeable battery
- The battery powers the data logger when there is no input power supply to the system
- The battery should not be allowed to discharge below 10.5 volts

10.20 Ethernet Module

Campbell Scientific's NL115 Ethernet/Compact Flash Module provides two independent capabilities:

(1) Enables Ethernet communications via internet and

(2) Stores data on a removable Compact Flash card. It allows the data logger to communicate over a local network or a dedicated Internet connection via TCP/IP.

It also expands on-site data storage and provides the user with a convenient method of transporting data from the field back to the office. This small, rugged communication device connects to the 40-pin peripheral port on a CR1000 or CR3000 data logger.

10.21 Connection Between Data Logger, Battery, and Multiplexer

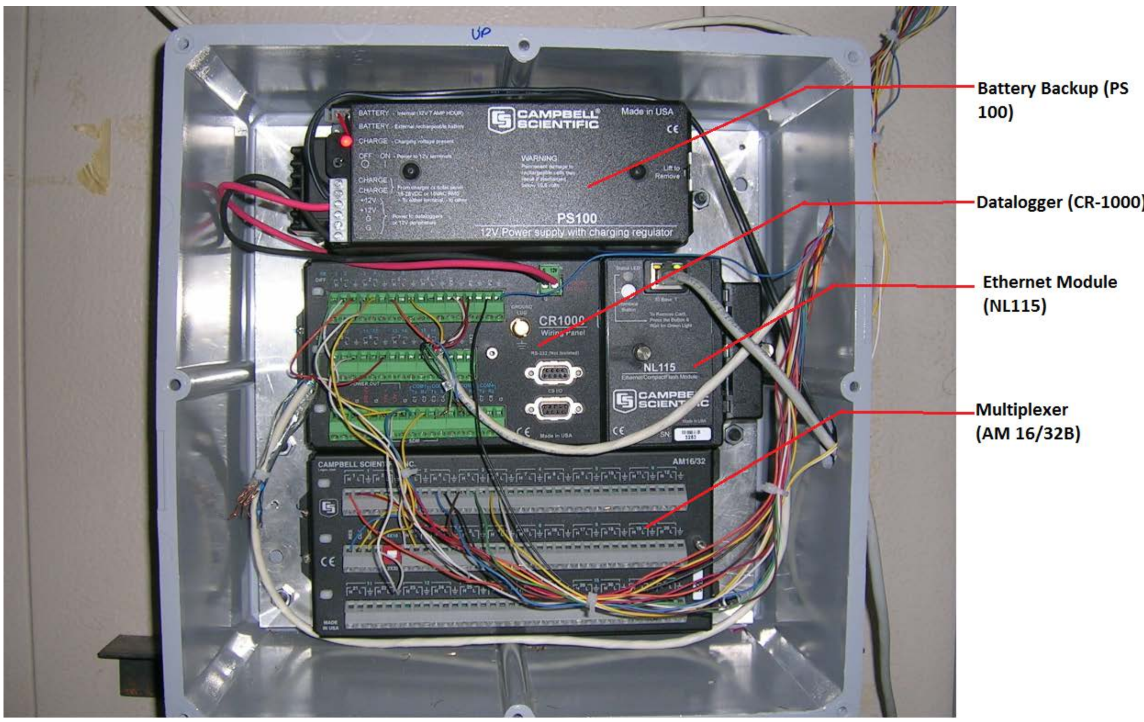


Figure 230 Connections between data logger , battery and multiplexer

- The battery powers the data logger
- The CR-1000 data logger is the main data logging unit
- The multiplexer AM16/32B allows additional sensors (a maximum of 32 two-legged sensors) to be fit in the system for data-logging apart from the data logger’s regular capacity
- The Ethernet module(NL-115) fits onto a 40 pin peripheral port on the CR-1000 unit
- The network cable needs to be connected to the NL-115
- The personal computer in ESL with logger net installed on it, communicates with the data logger through the Ethernet module
- The complete wiring diagram for all connections is as shown below
- The Ethernet module also has provision for a memory card, which can store the data from the data logger

HMP45C (6-wire, constant power)	CR1000
Yellow	1H
Blue	1L
White	⏚ (Ground)
Black	⏚ (Ground)
Clear	⏚ (Ground)
Red	12V

AM16/32 Multiplexer (2x32 mode)	CR1000
COM Ground	⏚ (Ground)
COM ODD H	2H
COM ODD L	2L
Gnd	G
12V	12V
Res	C1
Clk	C2

034A/034B Wind Speed & Direction Sensor	CR1000
Black	⏚ (Ground)
White	⏚ (Ground)
Clear	⏚ (Ground)
Green	3H
Blue	EX1
Red	P1

014A Wind Speed Sensor	CR1000
Clear	⏚ (Ground)
White	⏚ (Ground)
Black	P2

Figure 231 circuit/wiring diagram-connections for datalogger and datalogger-multiplexer combo

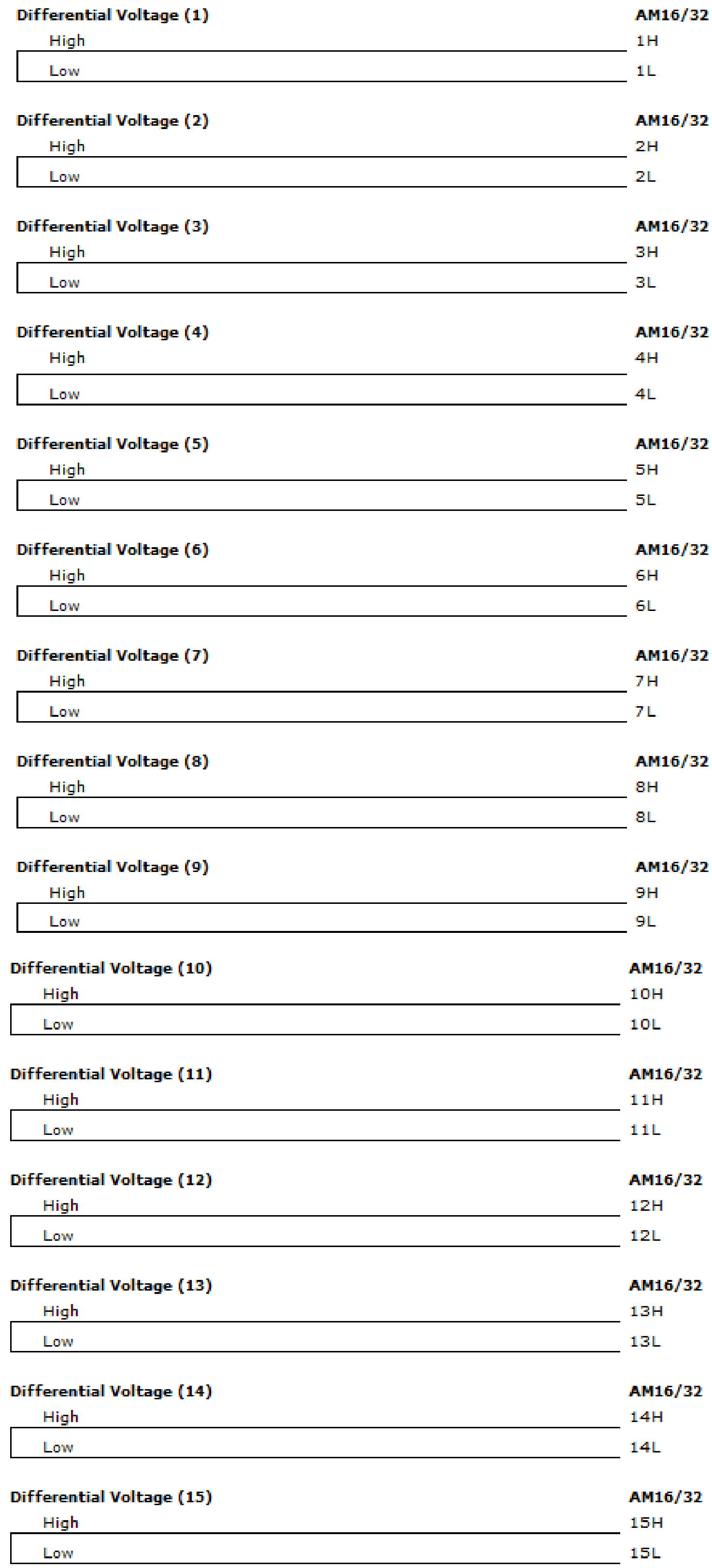


Figure 232 circuit/ wiring diagram-connections for sensors-multiplexer

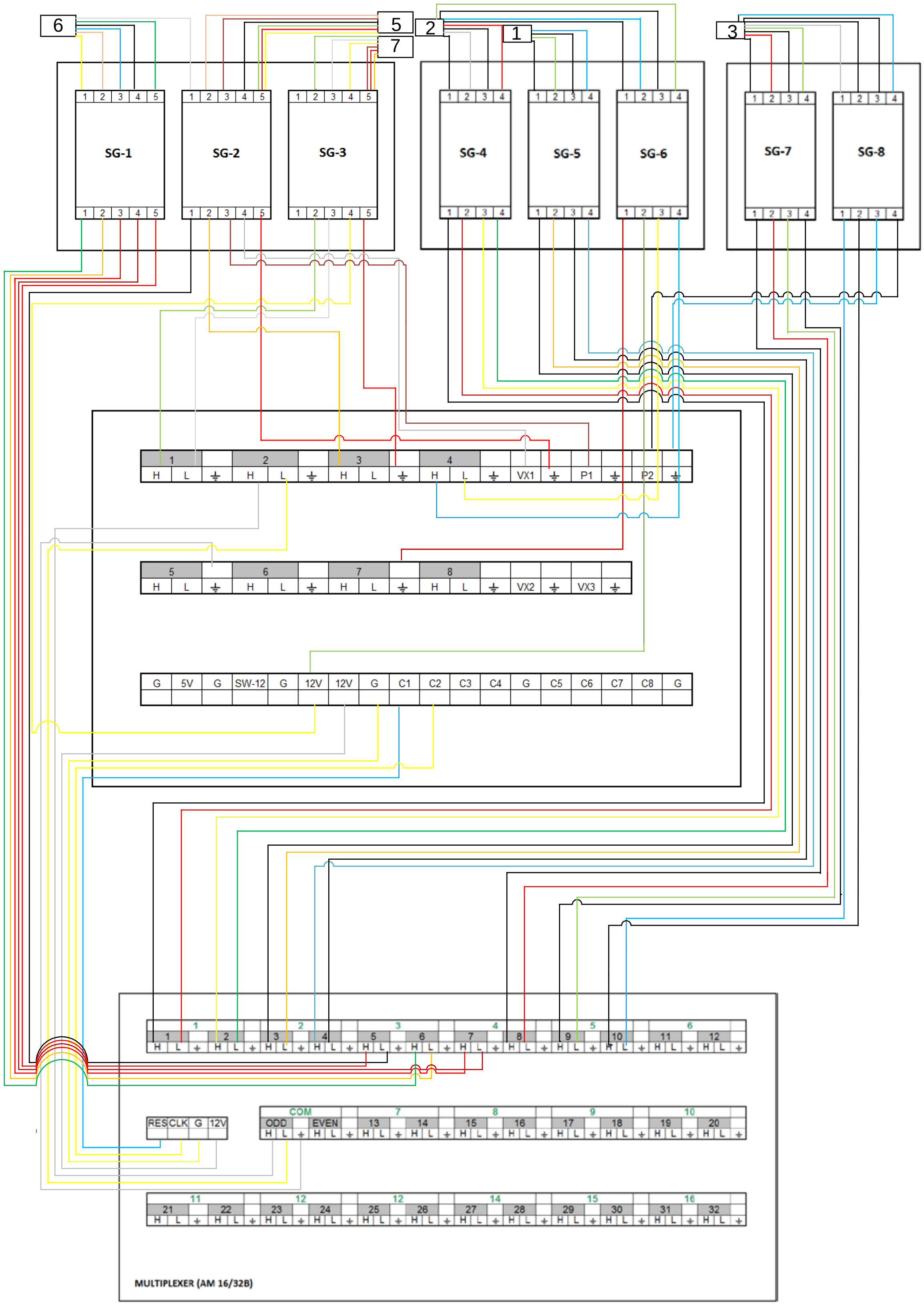


Figure 233 Comprehensive wiring Diagram

10.22 Data Logger Program

```
'CR1000
'Created by Short Cut (2.8)

'Declare Variables and Units
Dim LCount_5
Public Batt_Volt
Public AirTF
Public RH
Public DiffVolt(15)
Public WS_mph
Public WindDir
Public WS_mph_2

Units Batt_Volt=Volts
Units AirTF=Deg F
Units RH=%
Units DiffVolt=mV
Units WS_mph=miles/hour
Units WindDir=degrees
Units WS_mph_2=miles/hour

'Define Data Tables
DataTable(Table1,True,-1)
	DataInterval(0,30,Sec,10)
	Average(1,Batt_Volt,FP2,False)
	Average(1,AirTF,FP2,False)
	Maximum(1,RH,FP2,False,False)
	Average(1,WS_mph,FP2,False)
	Sample(1,WindDir,FP2)
	Average(1,WS_mph_2,FP2,False)
	Average(1,DiffVolt(1),FP2,False)
	Average(1,DiffVolt(2),FP2,False)
	Average(1,DiffVolt(3),FP2,False)
	Average(1,DiffVolt(4),FP2,False)
	Average(1,DiffVolt(5),FP2,False)
	Average(1,DiffVolt(6),FP2,False)
	Average(1,DiffVolt(7),FP2,False)
	Average(1,DiffVolt(8),FP2,False)
	Average(1,DiffVolt(9),FP2,False)
	Average(1,DiffVolt(10),FP2,False)
	Average(1,DiffVolt(11),FP2,False)
	Average(1,DiffVolt(12),FP2,False)
	Average(1,DiffVolt(13),FP2,False)
	Average(1,DiffVolt(14),FP2,False)
	Average(1,DiffVolt(15),FP2,False)
EndTable

'Main Program
BeginProg
	Scan(5,Sec,1,0)
		'Default Datalogger Battery Voltage measurement Batt_Volt
		Battery(Batt_Volt)
		'HMP45C (6-wire, constant power) Temperature & Relative Humidity Sensor
measurements AirTF and RH
```

```
        VoltSE(AirTF,1,mV2500,1,0,0,_60Hz,0.18,-40)
        VoltSE(RH,1,mV2500,2,0,0,_60Hz,0.1,0)
        If RH>100 And RH<108 Then RH=100
        'Turn AM16/32 Multiplexer On
        PortSet(1,1)
        Delay(0,150,mSec)
        LCount_5=1
        SubScan(0,uSec,15)
            'Switch to next AM16/32 Multiplexer channel
            PulsePort(2,10000)
            'Generic Differential Voltage measurements DiffVolt() on the AM16/32
Multiplexer:
            VoltDiff(DiffVolt(LCount_5),1,mV25,2,True,0,_60Hz,1.0,0.0)
            LCount_5=LCount_5+1
        NextSubScan
        'Turn AM16/32 Multiplexer Off
        PortSet(1,0)
        Delay(0,150,mSec)
        '034A/034B Wind Speed & Direction Sensor measurements WS_mph and WindDir
        PulseCount(WS_mph,1,1,2,1,1.789,0.629)
        If WS_mph=0.629 Then WS_mph=0
        BrHalf(WindDir,1,mV2500,5,1,1,2500,True,0,_60Hz,720,0)
        If WindDir>=360 Then WindDir=0
        '014A Wind Speed Sensor measurement WS_mph_2
        PulseCount(WS_mph_2,1,2,2,1,1.789,1)
        If WS_mph_2<1.01 Then WS_mph_2=0
        'Call Data Tables and Store Data
        CallTable(Table1)
    NextScan
EndProg
```

10.23 Changes Done to Accommodate the Data Collection of PSPs, LI-CORs

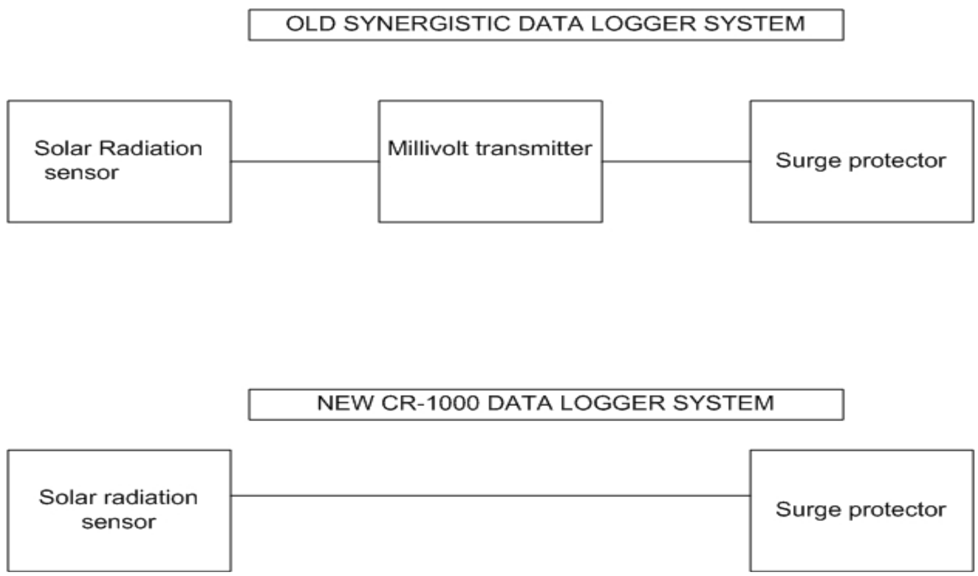


Figure 234 Changes in connecting PSPs and LI-CORs

Earlier in the old synergistic data logger, all the solar radiation sensors had milli volt transmitter between the sensor output and the surge protectors. Now the milli volt transmitters have been removed from the lines to enable the data logging process to function properly in the CR-1000 data logging system (the millivolt transmitters somehow are not compatible for use with CR-1000)

10.24 The Energy Systems Lab Cluster

In this cluster we will see about

- Software used
- Results
- Data backup

10.25 Software Used

10.25.1 Loggernet

Figure 235 Loggernet

- Loggernet is a software application that enables users to setup, configure and retrieve data from a network of Campbell scientific data loggers and share this data over an Ethernet communications network
- This program runs in the background handling all data logger communications
- Stores the data from datalogger in a central location according to data collection schedule
- The stored data is used up by RTMC Pro files and RTMC webserver to display graphical images on webpage
- Other secondary applications:
    - Real time monitoring of data
    - Graphical viewing of data
    - Scheduling automatic data collection
    - Downloading data from the data logger cache (customized downloads available)
    - Develop and edit programs using shortcut application and CR-basic editor
    - Setting up and managing different data loggers
    - Monitor status of networks
    - A stripped down version of RTMC-pro (used for developing webpage) is also available without advanced features

10.25.2 RTMC PRO

- RTMC (Real Time Monitor and Control) pro software provides the availability to create and run graphical screens to display real time data as Logger net collects it from the data logger
- RTMC pro is used to create and edit a real time display screen to display the data collected from the data loggers
- The screens thus create are the *.rtmc files. These *.rtmc file are loaded and displayed on the web by using the “RTMCwebserver” software.
- The various displays are available
    - Digital &analog displays, status bars, gauges

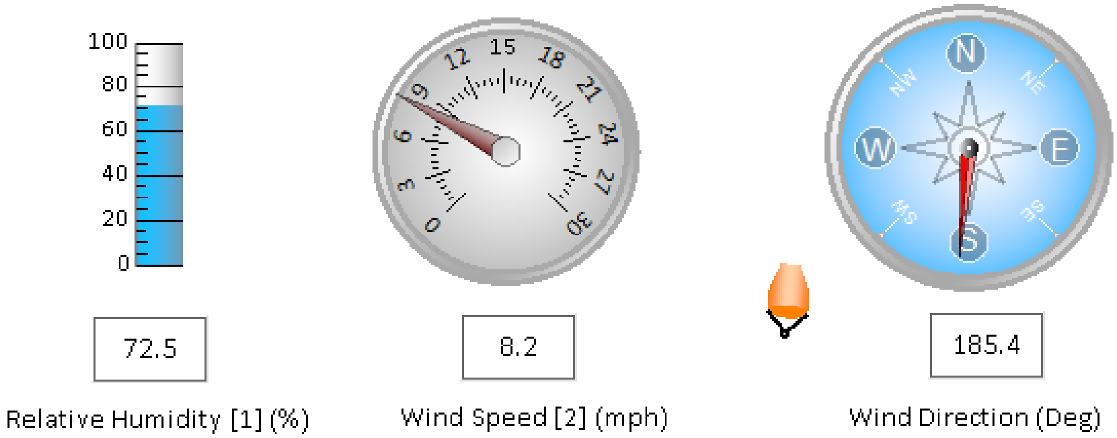


Figure 236 RTMC pro- digital& analog displays, status bars, gauges

- Time series and xy-plots

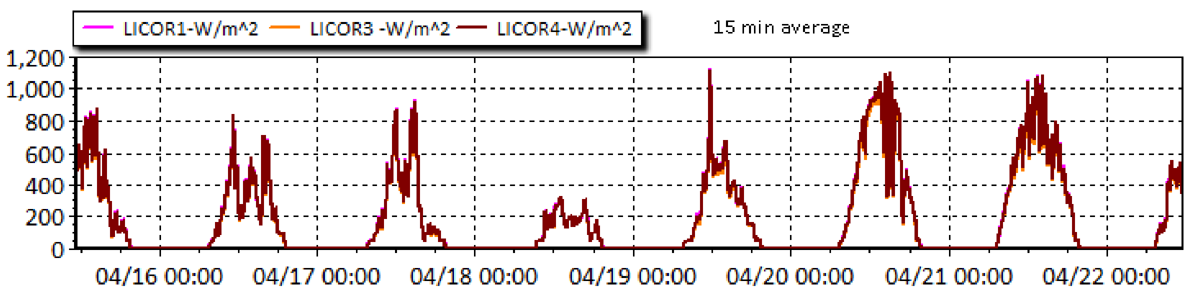
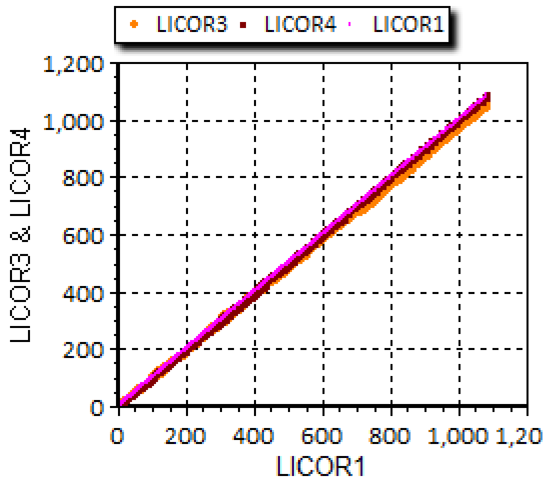


Figure 237 RTMC pro-time series and xy-plots



,

Figure 238 RTMC pro-time series and xy-plots

- Alarms-alarms are used to alert the person in charge in case a prespecified event happens. For example if the battery voltage falls below a certain value an alarm is witched on (on the webpage display) and an email is sent to person in charge.
  - No data alarm
  - Numeric alarm
  - Rate of change alarm
  - Text alarm
  - Multi state alarm etc.
- Other tools like-switches, wind rose etc.

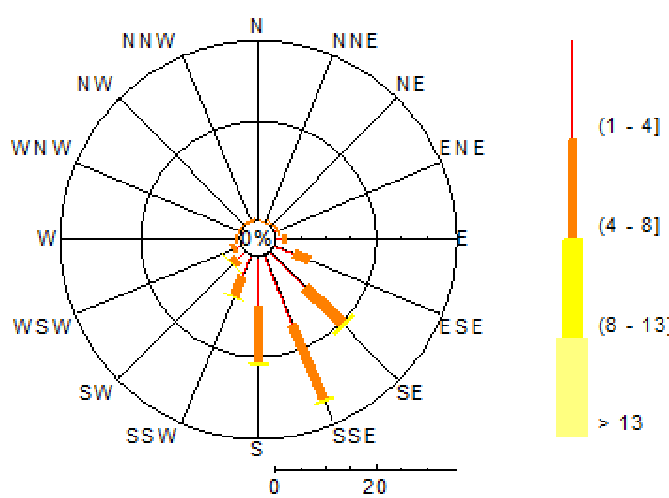


Figure 239 RTMC pro-wind rose

- Other standard webpage tools to make the webpage look shapely
  - Standard formatting tools
  - Text boxes and other layouts

  - Coloring, images and backgrounds
  - Adding html links

10.25.3 RTMC Webserver

- This software is used for displaying the real time data on the internet
- The RTMC webserver generates images from the *.rtmc files using up the data file stored in the central location by Loggernet software
- The screen gets updated according to the refresh settings (30 seconds in our case)
- The generated images are exported to internet browsers such as internet explorer, Firefox or opera
- The webpage is hosted on the PC which runs the “ RTMSwebserver” and can be viewed in the local domain
- The webpage can be hosted in a server to be able to be viewed in the World Wide Web.

10.26 Results

The objective of the solar test bench was to get real time displays on the webpage. The RTMC webserver is run in a PC in the Energy Systems Lab (ESL). The RTMC webserver uses the data file stored in a certain location in the PC. This data file is updated at frequent intervals (automated and scheduled collection of data from data logger) by the Loggernet. The following pages show the different screen shots developed using RTMC pro and hosted using RTMC webserver.

- Figure 240is a screen shot that shows all the current conditions in a nutshell-temperature, humidity, wind speed, wind direction, solar radiation
- Figure 241 is a screen shot that shows the weather conditions in the last 24 hours
- Figure 242 is a screen -shows the weather conditions in the last 7 days
- Figure 243 is a screen shot that shows the wind speed and wind direction in the last 24 hours
- Figure 244 is a screen shot that shows the solar radiation readings by LI-COR sensors in the last 7 days
- Figure 245 is a screen shot that shows the solar radiation readings by PSP sensors in the last 7 days
- Figure 246 is a screen shot that shows the comparison of solar radiation readings

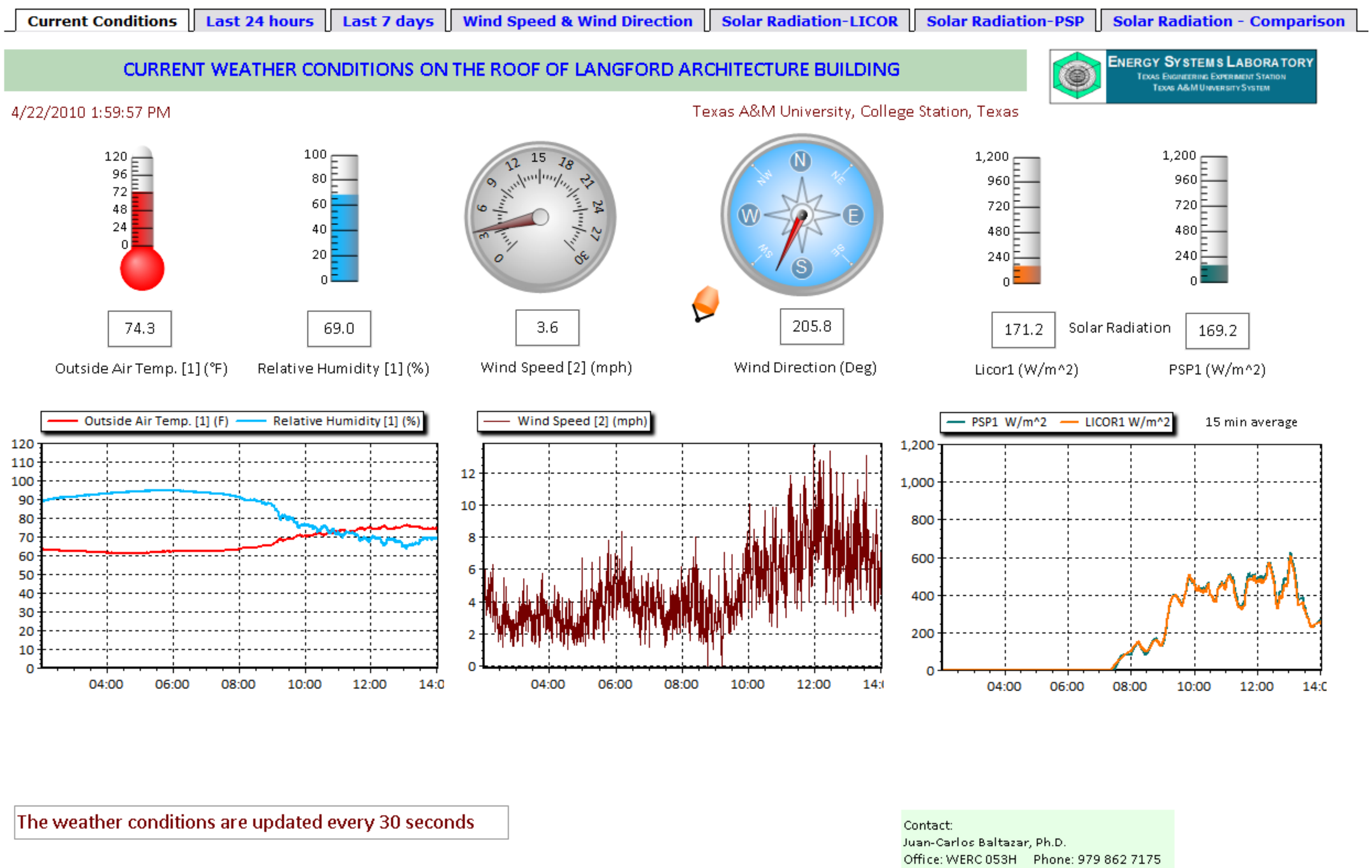


Figure 240 RTMC webserver screen1

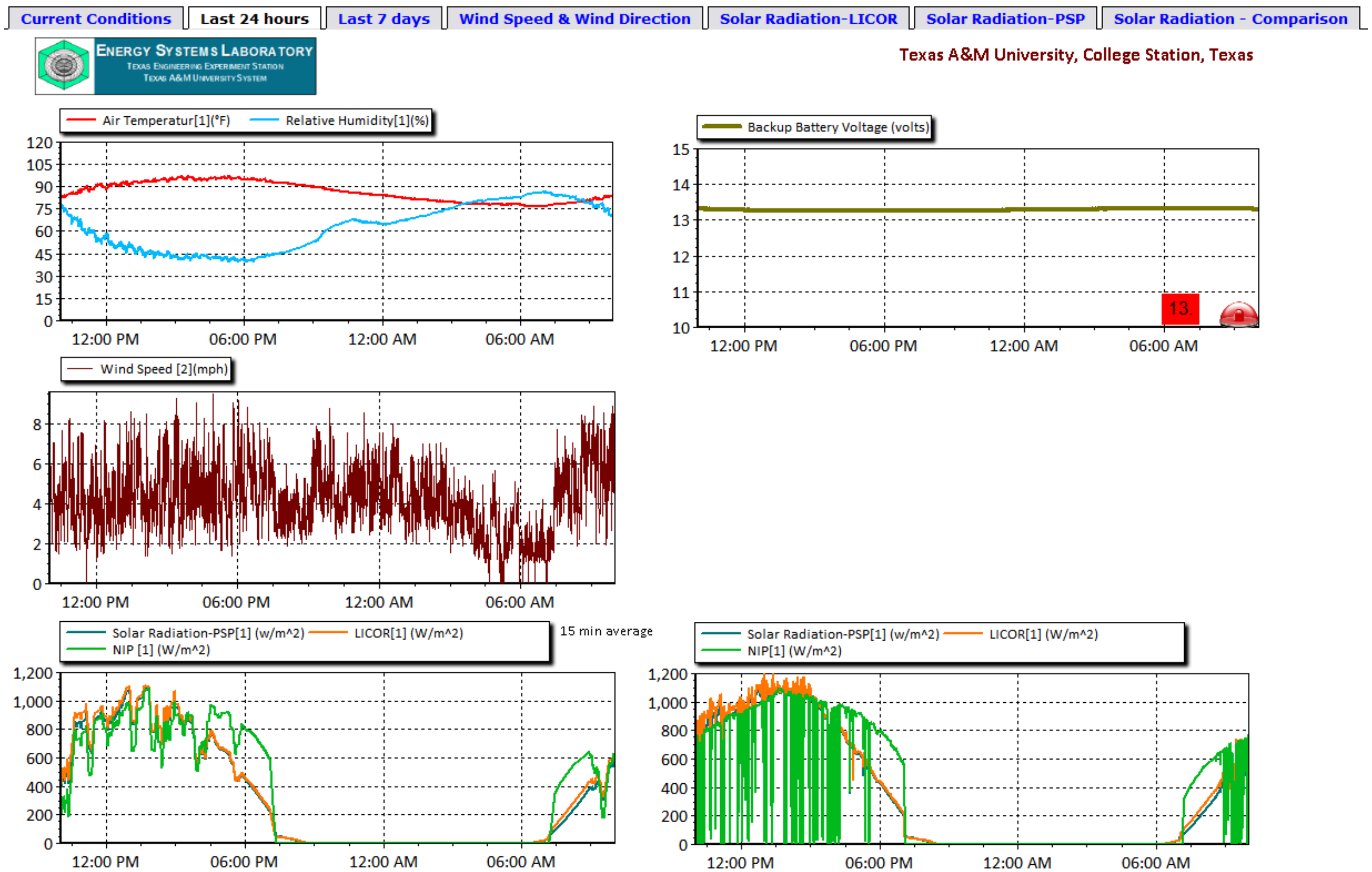


Figure 241 RTMC web server -screen shot 2

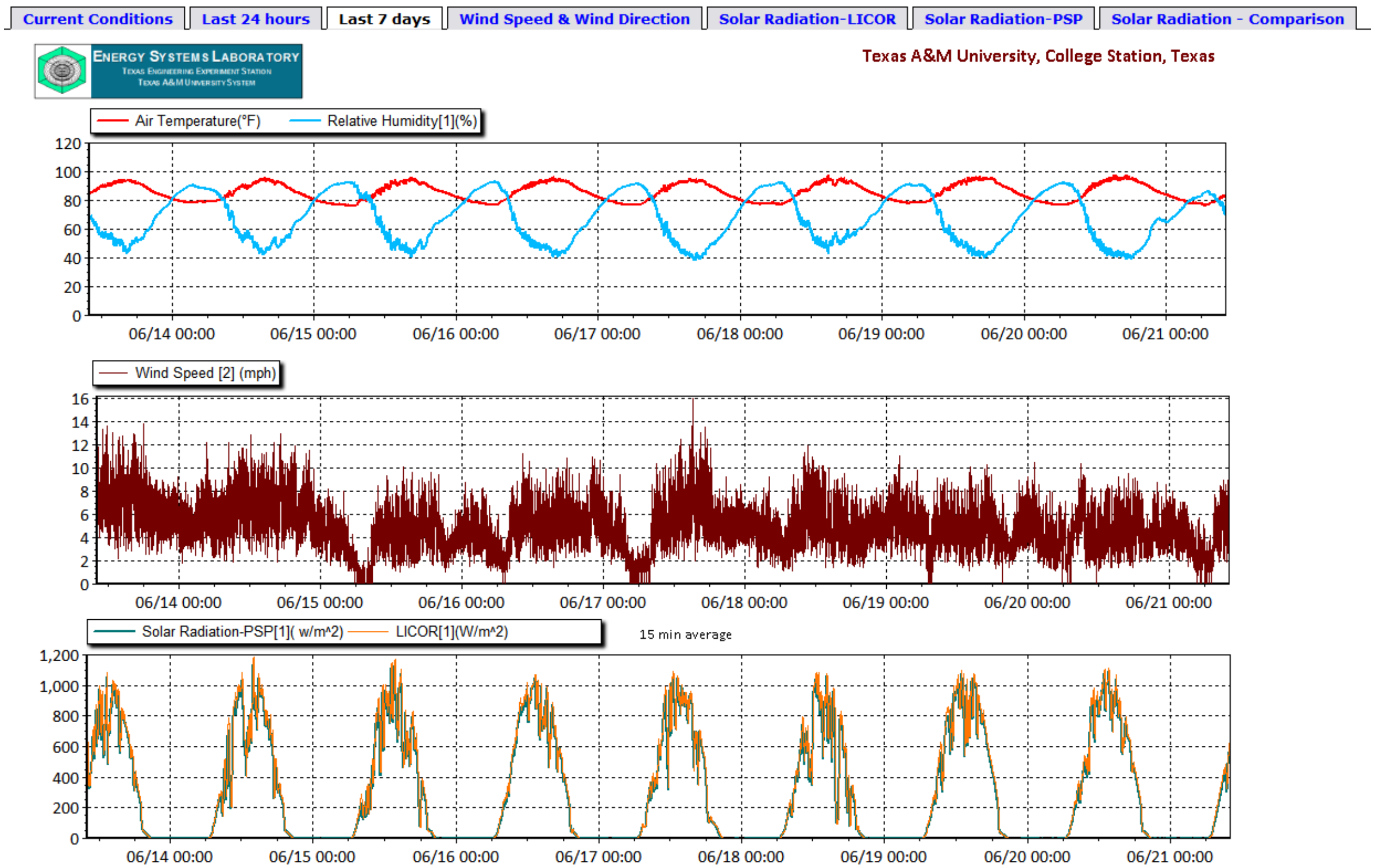


Figure 242RTMC web server -screen shot 3

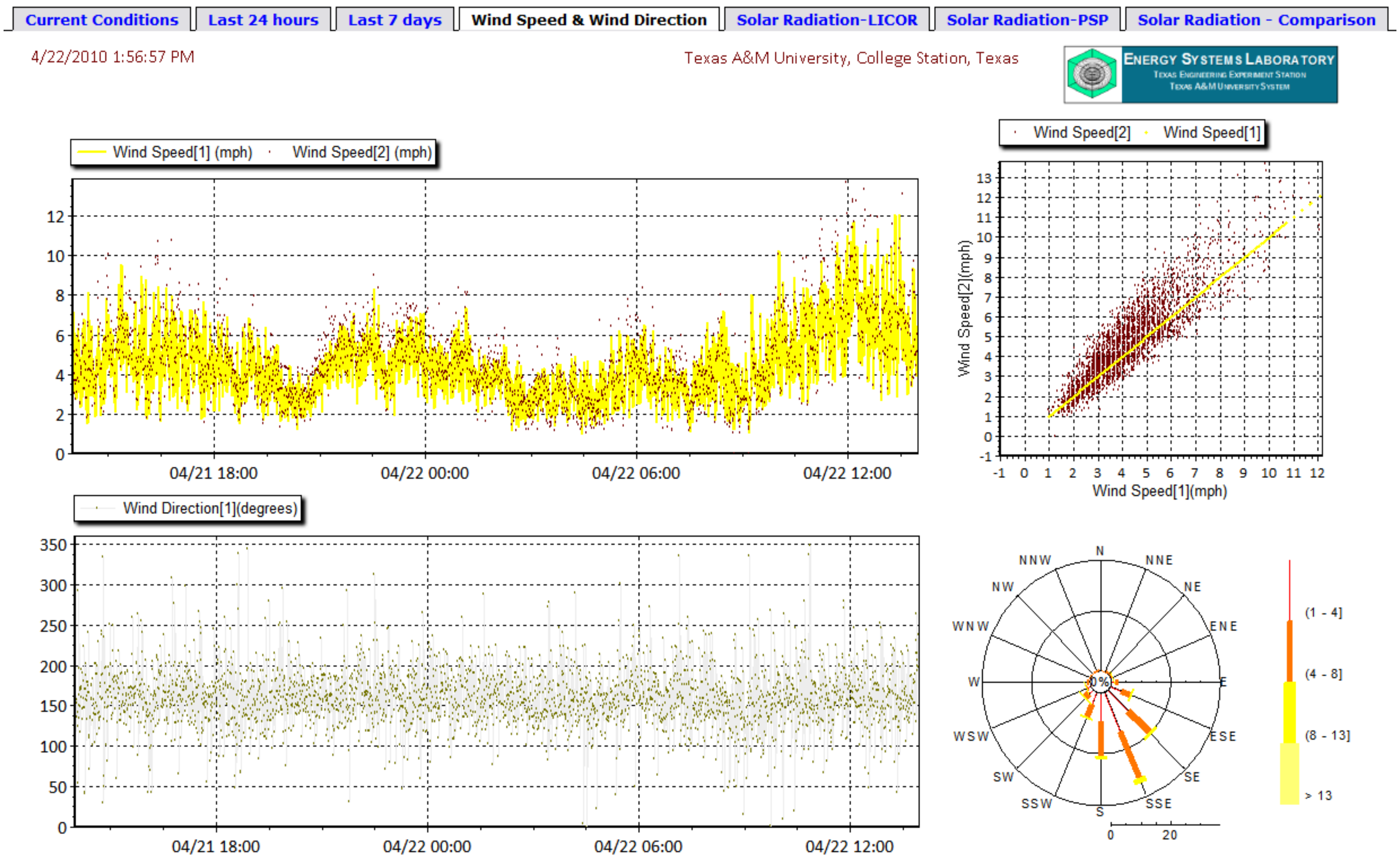


Figure 243 RTMC web server -screen shot 4

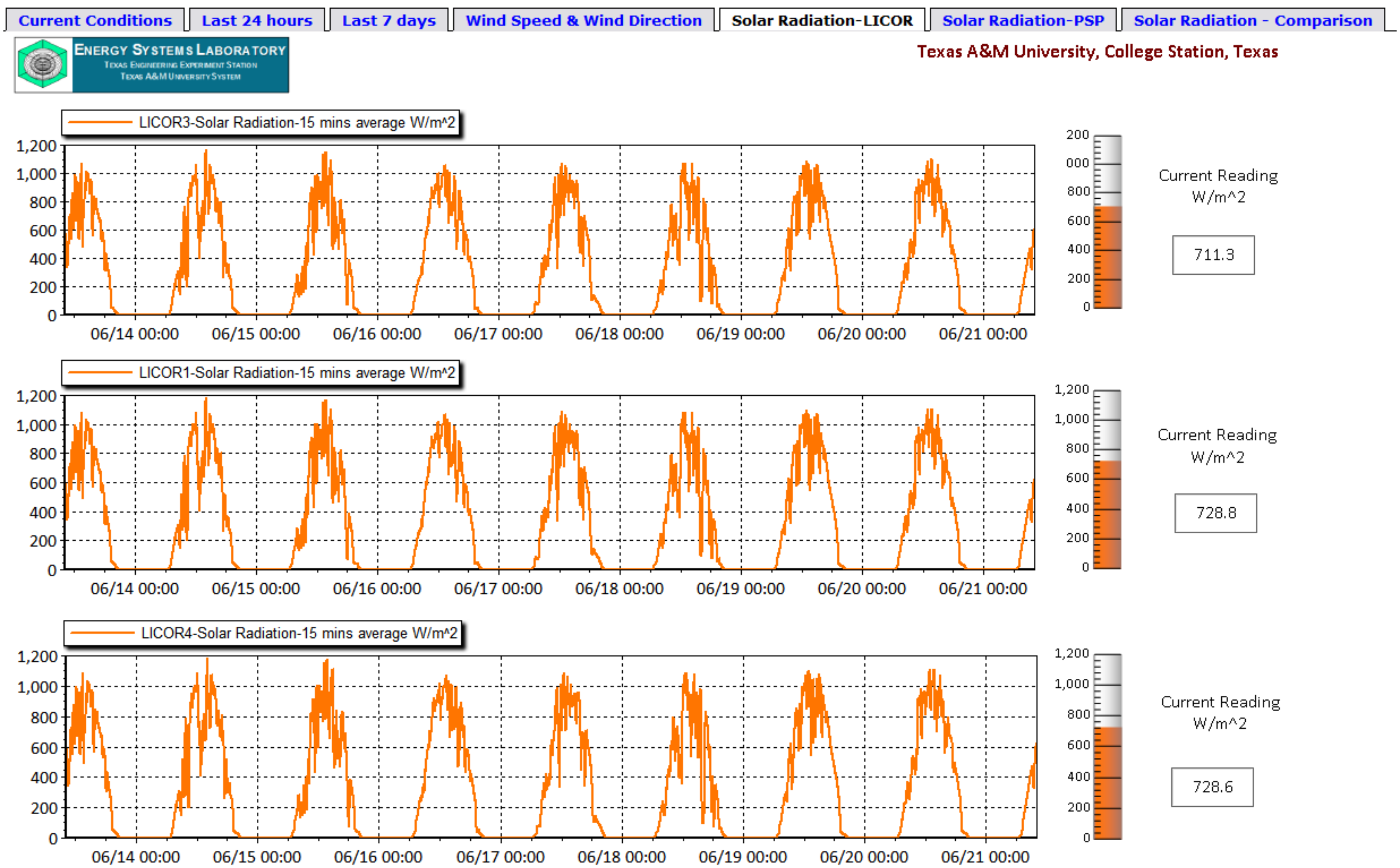


Figure 244 RTMC web server -screen shot 5

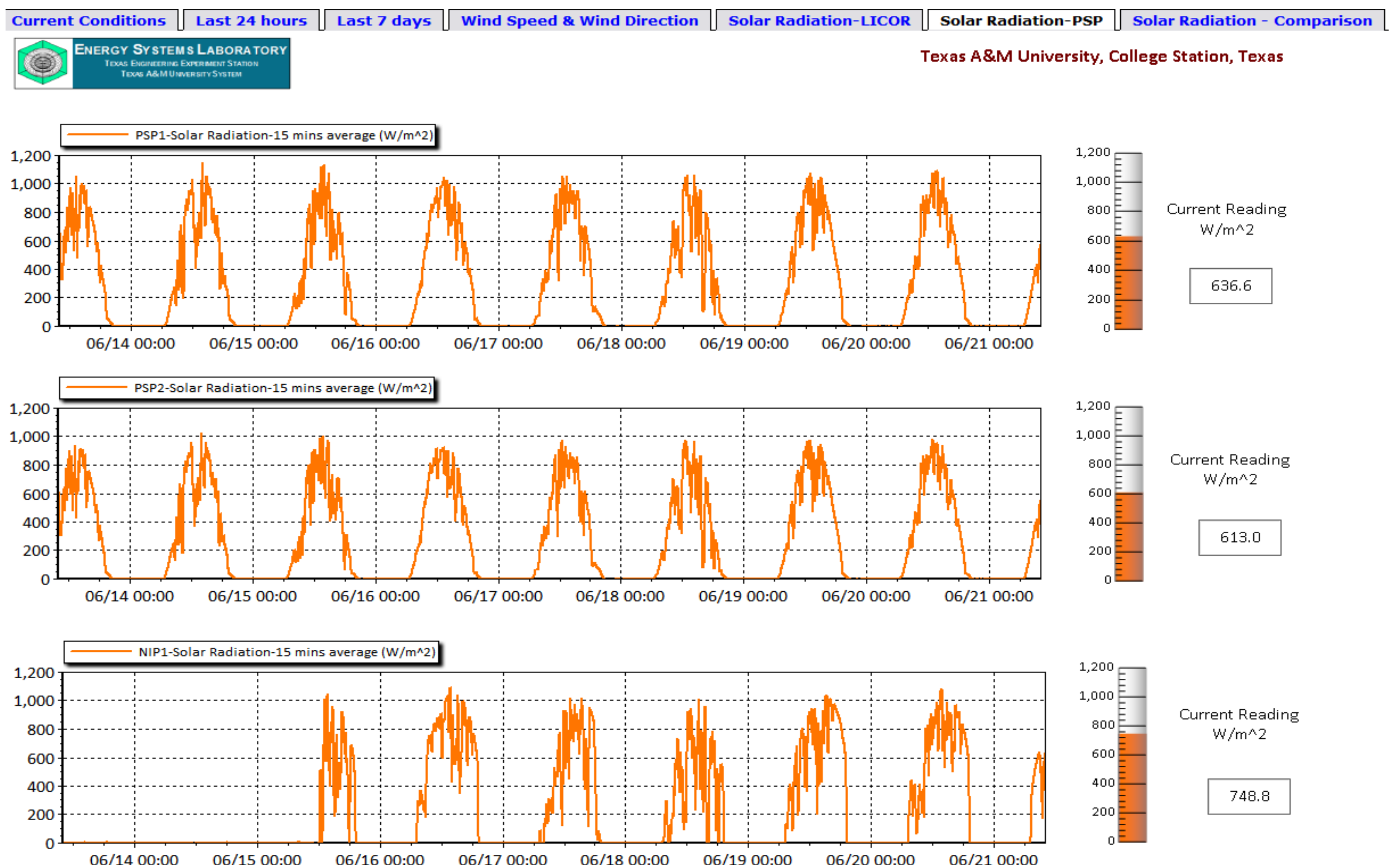


Figure 245 RTMC web server -screen shot 6

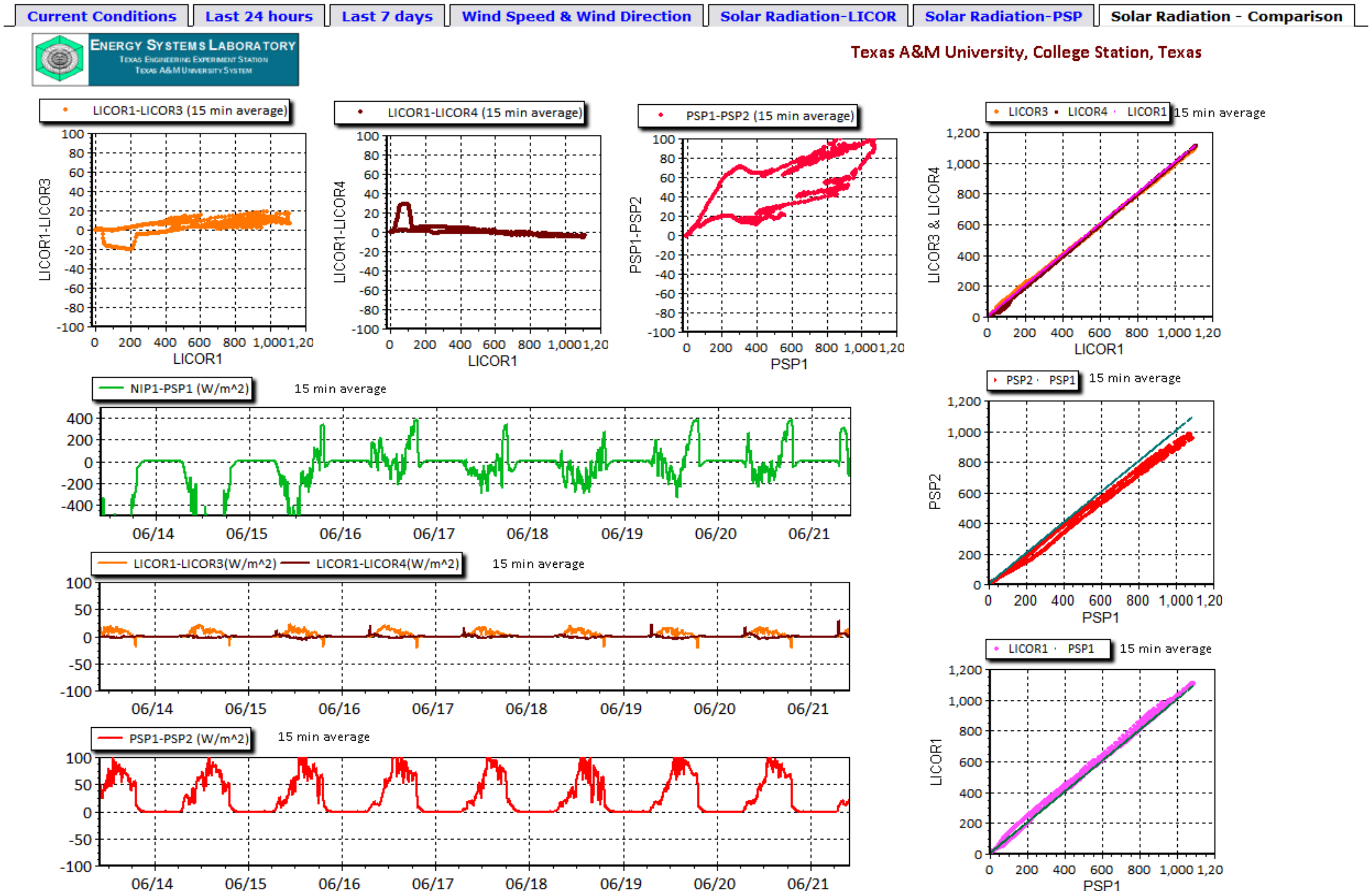


Figure 246 RTMC web server -screen shot 7

10.27 Data Back-up

Figure 247 Bazaar software-logo

- The data downloaded from the data logger by using Loggernet is stored in a central location
- This data file needs to be backed up
- Data is being backed up every 5 minutes by using a software called “Bazaar”
- The Bazaar overwrites the backup file every 5 minutes (back up file is stored in a specified location)
- It saves the changes that happen to the central data file (saved by Loggernet)
- The bazaar is powered by windows task scheduler
- The windows scheduler runs the specific code for Bazaar every 5 minutes
- The whole file can be regenerated at any point in time by the user (right from the first backup to the last backup)

10.28 Other Activities

10.29 1 Determination of True South

Figure 248 Determination of True south

- The true south line was required to be marked on the bench with the highest precision possible
- The zero scale of the wind direction sensor needs to point along the true south line

- A plum bob suspended from a support by a thread was used.
- The direction formed by the thread exactly at solar noon was marked
- The same experiment was repeated for a number of days before the true south line was marked on the solar test bench

10.30 Securing of the Solar Test Bench

- The solar test bench was secured on all four sides using metal ropes, rope clamps, eyebolts turn buckles
- The ropes were secured to the grill below by using turnbuckles
- The securing was done to reduce the vibrations in the solar test bench

Figure 249 Securing of solar test bench

10.31 Conclusion

- New sensors were setup on the old solar test bench in addition to the old sensors
- New junction box's with extra cables were installed to accommodate the new sensors in the bench
- A state of the art CR-1000 data logger and accessories were setup, installed and programmed
- The connections between the solar test bench-surge protectors-data logger was setup
- Softwares were used to automate data logging, downloading and displaying the real time plots and data on a webpage

10.32 Future Goals

The future goals include:

- Setting up a database of data so that data for the required date range can be pulled out by anybody who wants data for further analysis
- Adding some more sensors to the present pool of sensors on the solar test bench
- Getting the webpage onto the internet

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